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Mariners Weather Log

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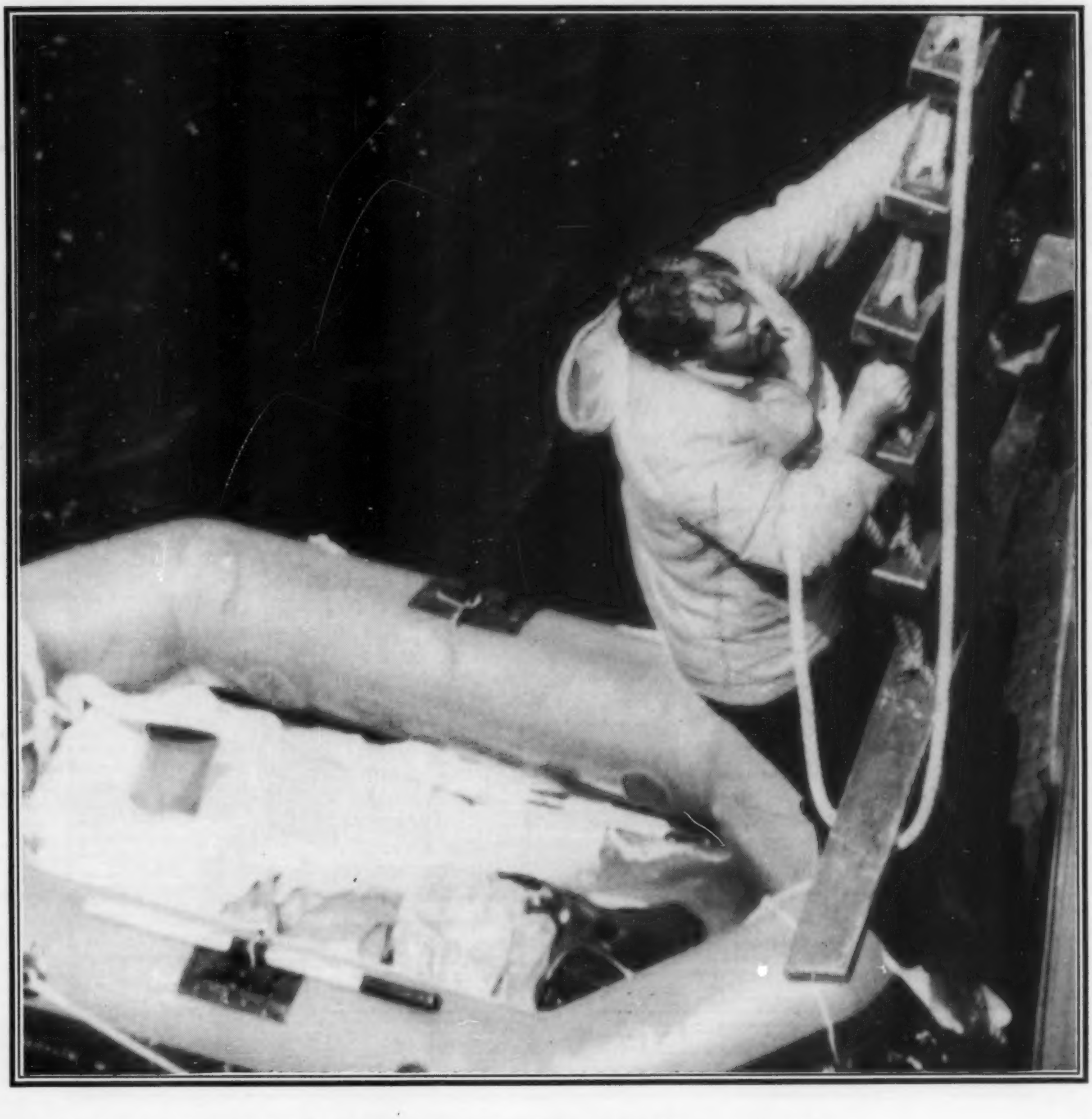
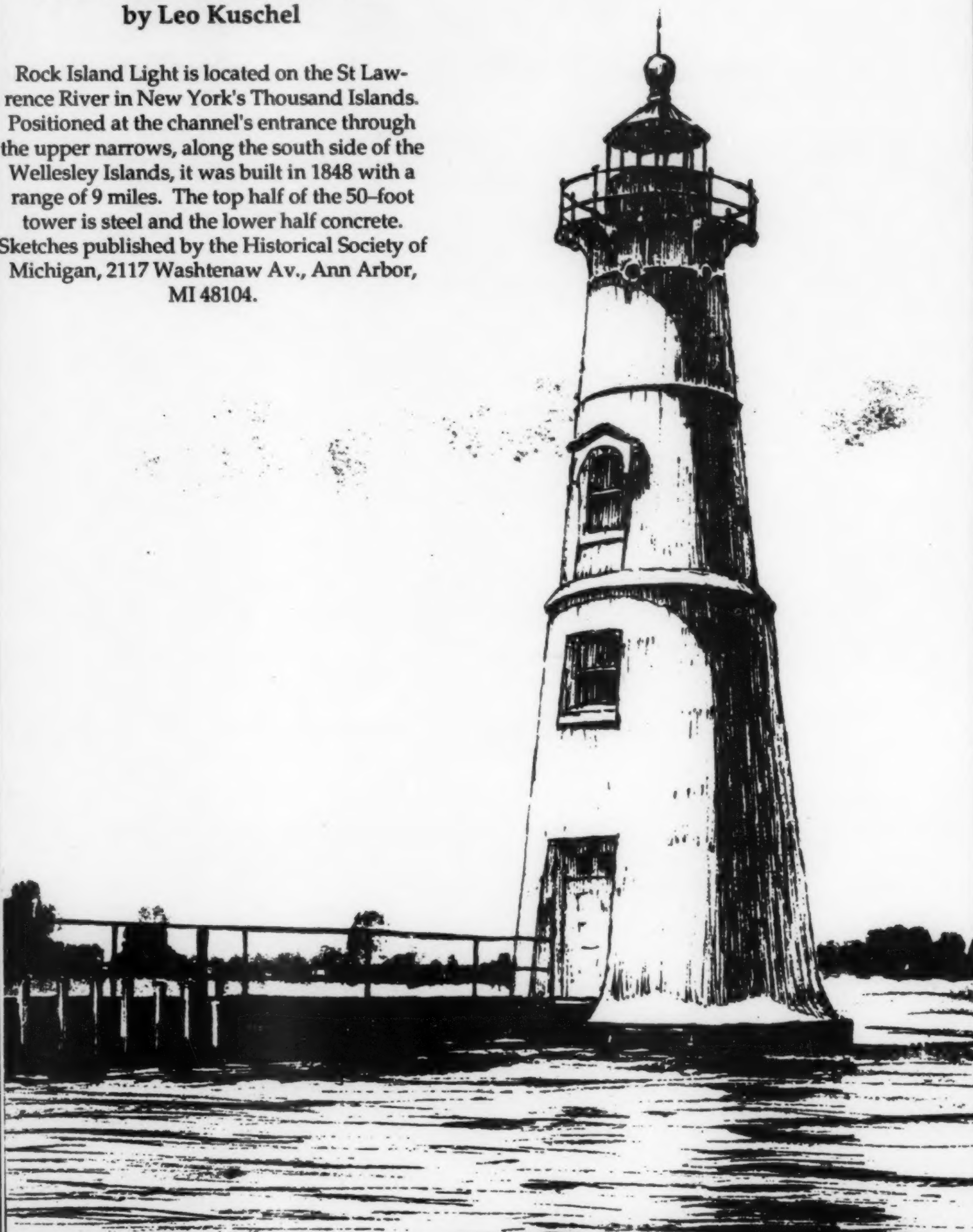


In this issue: A new lighthouse column by Elinor DeWire, page 20

Rock Island Light
St. Lawrence River, New York
by Leo Kuschel

Rock Island Light is located on the St Lawrence River in New York's Thousand Islands. Positioned at the channel's entrance through the upper narrows, along the south side of the Wellesley Islands, it was built in 1848 with a range of 9 miles. The top half of the 50–foot tower is steel and the lower half concrete. Sketches published by the Historical Society of Michigan, 2117 Washtenaw Av., Ann Arbor, MI 48104.



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Richard M. DeAngelis

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Cover: Nick Dunn climbs to safety aboard the Venus Diamond after shooting his last flare. It took the 720-ft vessel 11 miles before it could turn around and go back for him (pg 2).
Back Cover: Hurricane Ramon helped put out this fire near Mt. Palomar (pg 12). U.S. Forest Service photo.

U. S. DEPARTMENT OF COMMERCE
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Features

Departments

Marine Weather Review

the Will to Live

— by William Sisson
Soundings

"We are now but little better than starving... yet the risk was so great to get that relief that prolonging of life even in the midst of misery is preferable while we have hope of surmounting all our hardships."

— Captain Bligh

Originally appeared in the March 1988 *Soundings*

After spending nearly six torturous days in an inflatable dinghy off Costa Rica, Nick Dunn decided to kill himself.

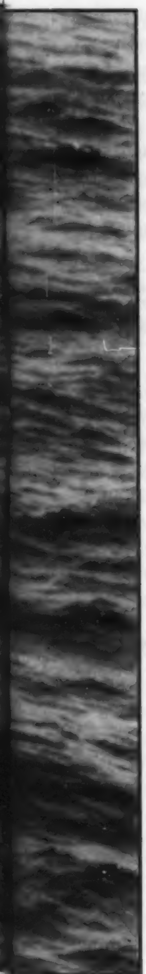
The solo sailor planned to cover his head with a plastic bag, wrap it tightly with silver duct tape and then lie down and wait for the pain to stop. "The coward's way out," said Dunn, a pilot who lives in the Florida Keys.

He was cold and depressed and covered with saltwater sores. "I was just surrounded by pain," said Dunn, who was sailing his 26-foot trimaran from California to Key West when it capsized.

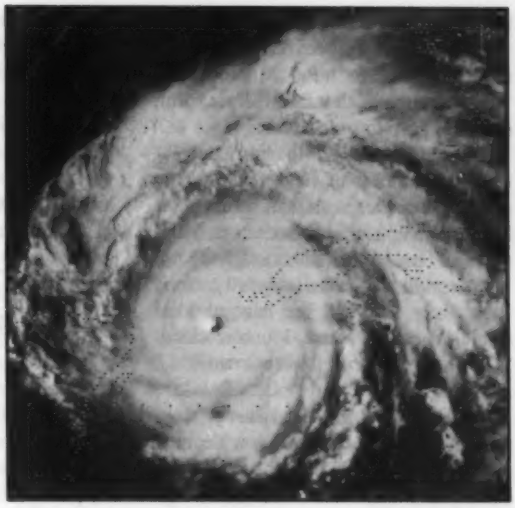
But the sun came out that morning for the first time since his ordeal began and that was reason enough to hold out a little longer. Later that day, Dunn was rescued by a Japanese car carrier.

Nick Dunn's story is a story of survival, and it is shared by scores of mariners. It is a testament to the stoicism and resourcefulness of those boaters who, like Dunn, face death and somehow endure. It is a story of luck and heroism, hope and despair.

One point clearly emerges from interviews with rescue ex-



Nick Dunn (left) awaits rescue by the 720-foot ***Venus Diamond*** *after 6 days of stormy weather. Allen poses, just a few hours before reaching a pressure of 899 millibars. Only the famous "Labor Day Hurricane," which struck the Florida Keys in 1935 with a central pressure of 892 millibars, had a lower pressure.*



" I believe what's written is written. If you're born to hang, you're not going to drown"
— Tom Dower

perts, and accident victims: Survival is as much a grinding psychological ordeal as it is a physical one.

Survival specialists say there is no underestimating the role that the mariner's attitude plays in his rescue. It is that internal fortitude that keeps boaters holding on through pain and hunger and thirst.

"The way to deal with it is called the will to survive," said Air Force Sgt. David Doss, a water survival instructor at the Air Force Base in Homestead, FL. "People will know what their's is when they're tested. That's the only way to measure It." Tom Dower was tested and he proved to have plenty of grit. The crusty 70-year-old sailor from Newfoundland was single-handing his 33-foot ketch-rigged vessel home from Florida on a moonlit night when it was struck by a commercial vessel off the coast of Virginia.

"They cut the stern right off of her," said Dower, who broke four ribs and suffered a punctured lung in the collision. "They cut me down and kept on going. I didn't get a chance to grab anything."

Dower spent the remainder of the night — the collision occurred around 1 a.m. — and most of the next day trying to hold himself on the overturned boat.

It was spring and the former merchant seaman and World War II submariner was dressed only in long johns and a navy undershirt. He was bleeding from cuts and three sharks were circling the boat, "waiting to make a sandwich out of me." the sailor said.

About 14 hours later, sailor Tom Linton spotted Dower perched on the nearly submerged wreck and pulled him to safety.

"Attitude is the main thing," said Mike Munroe who survived a severe pummeling in 1980 by Hurricane Allen, one of the five strongest hurricanes of the last 100 years, packing winds up to 165 knots. "With the right attitude and the minimum equipment, you can get by. If you've got water, you can survive almost anything.

Munroe, of Key West, and three companions lost a 49-foot wooden ketch when they went through the wall of that vicious storm. The fourth and final knockdown sent the sailors scrambling into their Givens life raft, where they spent two days before

being rescued by a freighter.

"That's really where the whole thing starts, in the life raft," Munroe said. "Once you have the survival platform, then you have to survive."

During the height of the hurricane, "it wasn't a matter of if we would die," he said. " It was the question of when." But as frightening as that episode was, Munroe said no one talked about giving up.

"The will to survive is awfully strong — it really is — all you have to do is adapt, " he said. And, Munroe added. "everybody had to pull his own weight." All four lived.

"The kind of guy who survives out there is a kind of bully — you know, a bully who gets into a fight in an alley and comes out alive," said Vic Shane, president of Para-Anchors Inc. in Santa Barbara, CA, which makes parachute sea anchors. If you're a namby pamby type — wishy washy — and rely on the trappings of society, don't take chances."

Shane took a chance in 1979, when he sailed a 24-foot trimaran to Hawaii and back.

Wayne Williams, director of Nova University's Institute for Survival Technology, believes that most Americans are too soft to survive long at sea.

"We're supported by so many things in our everyday life, and I'll tell you something, that doesn't tend to make you a very good survivalist," Williams said.

Coast Guard Cmdr, Edmund Labuda, chief of the National Search and Rescue School on Governor's Island, NY, said that in any disaster , 90 percent of the victims will need help. About five percent actually may hinder survival. The remainder will do everything to survive.

"They're going to save themselves," said Labuda of that small minority. "They're going to give it every shot they've got."

While rescuers marvel at the tenacity and perseverance demonstrated by survivors, they remain perplexed and disturbed by those who seem to capitulate with little struggle.

" Food on Hamilton's raft was ... handed out publicly — none of this 'Hey Joe can I have another sip of water'...."

Doss, the Air Force survival instructor, has a category for it: "give-up-itis."

"Over a period of time, you give up, Doss said. "You figure no one is going to rescue you."

"Some people will just die," said retired Coast Guard Capt. John Waters, a former chief of search and rescue at the

Gambling on Safety Means High Stakes

—by William Sisson
Soundings

Mark Spagnuolo and David Niederst took the minimum amount of safety equipment on their fishing trip, and it almost was their last one.

Wrapped in garbage bags and shivering in their disabled 16-foot outboard, they fired four flares at a Lake Erie ore carrier and low-flying aircraft. The flares were not seen.

After spending 48 hours adrift on the lake — much of it in 10-foot seas and high winds — they were rescued by the Coast Guard.

Rescue veterans say the two were like thousands of other recreational boaters. They came up short in an area in which many boaters are lacking — safety equipment. They had no VHF–FM radio or warm clothing aboard. They gambled on the weather and almost lost everything.

And yet the brothers carried the minimum federal safety equipment such as flares and personal flotation devices (PFDs). But under the extreme conditions they found themselves in, that almost wasn't enough to save their lives.

"The minimum equipment required by federal law is just what it says — the minimum." said retired Coast Guard Capt. John Waters, a former their of search and rescue at Coast Guard headquarters in Washington, DC.

"But the public doesn't know it's the bare minimum," said J. Kelsey Burr, division manager of Survival Technologies Group, the St. Petersburg, FL., firm that manufactures and markets safety equipment. "Our biggest customer is the guy who's gotten into trouble."

Burr said he would like to see more mandated equipment aboard vessels. "We've been accused of selling fear, and I think that's wrong." said Burr, a sinking survivor himself. "What we're trying to sell is prudence."

" Satisfying the letter of the law is one thing, surviving a sinking or capsizing is another."

Interviews with disaster victims and survival specialists indicate that the minimum equipment simply is not sufficient at times — when flares are not seen or when one must abandon ship in rough seas wearing a PFD suitable only for calm waters.

Satisfying the letter of the law is one thing, surviving a sinking or capsizing is another.

Rescue professionals point to a variety of non-mandated safety equipment they think every boater should consider having aboard. Prudent boaters do carry more equipment than required. But many others don't, due to ignorance, cost or the attitude that, "it won't happen to me."

The needs of the inshore, coastal and offshore boater vary, but if there is one piece of equipment that safety officials stress

agency's headquarters in Washington, D.C. "That's a little hard to believe, but I've seen any number of cases where a person will die in the first five hours and others will last several days.

"It's a very hard thing to define, the will to survive."

John Leach, a psychologist at the University of Lancaster in England, who is studying behavioral reactions under survival conditions, questions whether the will to survive even exists.

"It doesn't explain anything," said Leach. "It's just a label, and it gives the impression of explaining things.

"The more interesting question is, Why do so many people die when they shouldn't have? Maybe we should look at the will to die."

The sinking of the 176-foot fishing vessel, ***West I***, provided a rare look at the two directions survival can take. The vessel sank about 600 miles northeast of Oahu, with the eight-man crew splitting up into two life rafts.

The day after the sinking, chief mate Thomas Jacobsen took a small damaged aluminum skiff, rigged a makeshift sail and with a compass and sextant, set out for Hawaii for help.

The two rafts, although tethered together, couldn't have been further apart in terms of spirit, according to Coast Guard Lt. Terry Walsh, who was the senior watch officer at the Joint Rescue Coordination Center in Honolulu at the time.

"What is fascinating about this case is that here, on the ocean, 30 meters apart, were these two little worlds, one stable and one not," Walsh said.

What made life in one raft so much more tolerable than on the other was the leadership of third mate Douglas Hamilton, Walsh said. Hamilton made each person stand a watch — morning and night. He decided when flares would be fired. There was discipline in Hamilton's raft and dissension in the other, Walsh said.

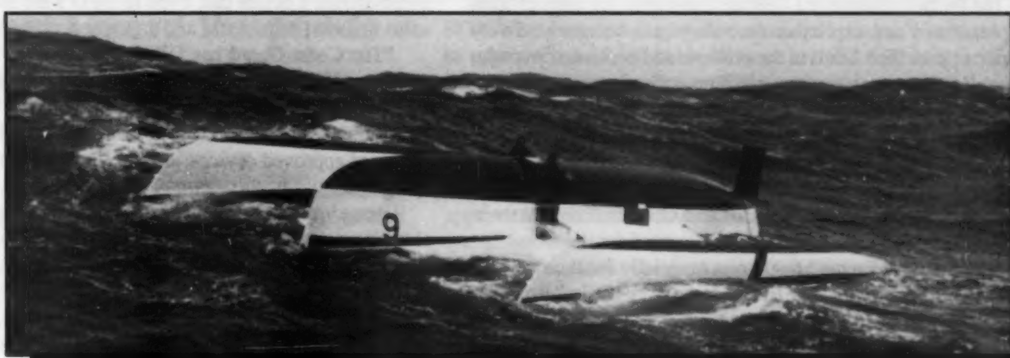
Food on Hamilton's raft was inventoried each day and handed out publicly - "None of this, "Hey Joe, can I have another sip of water," said Walsh. They mopped the raft dry regularly to prevent saltwater sores from developing.

"The other raft didn't do stuff like that . . . and they just sank deeper and deeper into despair and physical problems," Walsh said.

When they were rescued by a Naval vessel 2 weeks after the sinking, Walsh said, the men in Hamilton's raft were able to climb the boarding ladder; those in the other raft had to be lifted out on litters.

"They started off almost completely equal." Walsh said, "The same amount of food and water per person." Walsh noted the ship's captain died the day before the rescue, probably from dehydration and

Multihull builder Walter Greene and his crew await a Coast Guard rescue.



boaters carry, it is a VHF-FM radio.

"Radio communication is that vital link between you and help," said Lt. Guy Sorensen, who works within the agency's search and rescue office in Washington, DC. "If nobody knows you're in trouble, no body will be looking for you."

Some sailors consider radios more valuable than flares, especially in attracting the attention of ocean going ships that are more likely to be monitoring the radio than keeping a watch on the seas.

"I'm not big on flares," said multihull builder and sailor Walter Greene of Yarmouth, Maine, who capsized during a trans-Atlantic crossing in 1982. "I think they're worthless in the ocean. No one looks." In an emergency, Greene considers a portable VHF-FM radio in a watertight bag far more useful than flares.

Some of the most valuable and practical safety equipment is among the least expensive, such as watertight flashlights, signal mirrors and flags, seacock plugs, first-aid kits and heaving lines.

"A super watertight flashlight is very important to survival, much more important than flares," said Greene. "If you're groping around in the dark without a light, you're in trouble." When Greene's trimaran Gonzo capsized in 25-foot seas, the crew had three working lights.

Harry Bowman and Greg Bayne probably had six knives aboard Bayne's yawl, but when it was knocked down suddenly in the middle of the night, there wasn't time to grab one.

"And we could have used it a thousand times." said Bowman. "I don't care if you look like Rambo — wear a knife"

Rescue professionals also stress that survival is not just the concern of the offshore sailor.

"You can drown just as well two miles offshore as you can in the mid-Atlantic," said Waters. "The ocean is the most dangerous at its edges."

exposure.

After the life raft survivors were found, a massive air search was begun for chief mate Jacobsen who'd left in the skiff. Walsh said everybody who had been aboard the rafts was convinced he was still alive.

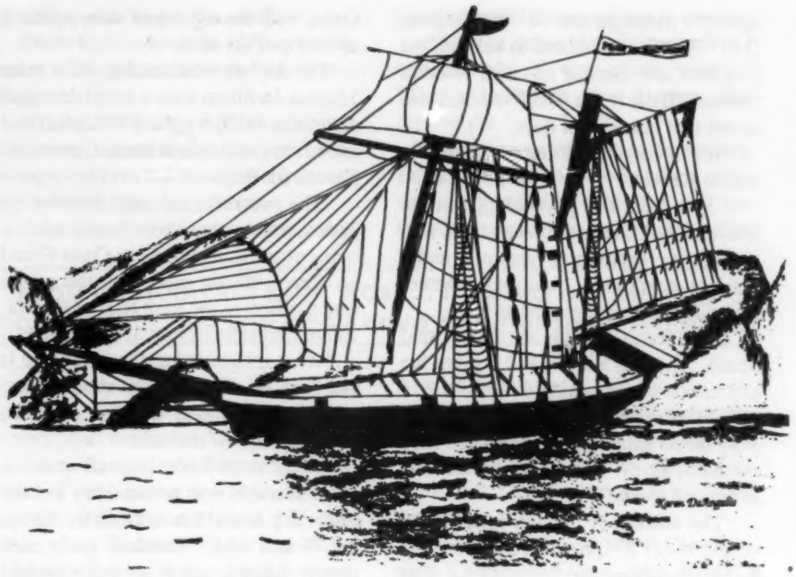
"They were absolutely certain that if anyone was going to survive, it would be Jacobsen," Walsh said, "He had told them I'll see you in Hawaii," and they believed him."

It was 17 days after the ***West I*** sank that chief mate Jacobsen landed on the Hawaiian Island of Niihau. Walsh said he was in good physical and mental shape. He insisted on carrying his own sea bag and even had some of his water rations left.

"He still had water. He still had those cans of water," Walsh said. "He was going to survive, damn it."

Those who do survive a harrowing episode at sea often are changed by it.

Joe McGeady was second mate aboard the schooner Pride of Baltimore when it was



The Pride of Baltimore

The farther offshore one ventures, however, the more crucial, sophisticated and expensive the safety gear becomes. Safety experts shake their heads at the offshore and ocean mariner who doesn't carry an emergency position indicating radio beacon (EPIRB), a life raft, a survival or exposure suit, a personal survival bag, a sea anchor or drogue, and man overboard gear.

"To put the money into an EPIRB is like an extra life insurance policy," said Coast Guard Lt. j.g. David Littlejohn, duty controller at the Joint Rescue and Coordination Center in Honolulu. "You can never be over-prepared for the worse."

Bowman and Bayne bought one especially for their voyage and it saved their lives. "The EPIRB is the story really," Bowman said.

And the signal from Greene's EPIRB guided rescuers to him and his crew. "An EPIRB is a better bet than anything else (offshore)," he said.

"... safety equipment alone is no guarantee of safety."

The safety and survival issue does not center just on what additional non-required equipment mariners should carry. Some safety proponents criticize certain mandated equipment for not being up to the job of saving lives.

Wayne Williams, president of the non-profit National Transportation Safety Association, for example, has waged a long campaign against lifejacket standards, particularly for the Type II and III PFDs.

Williams has charged that the Coast Guard, by promoting the wearability of PFDs over their performance, has contributed to recreational boating deaths. Williams said the Coast Guard has acknowledged in its rescue and survival manual and in a 1984 commandant's notice that Type III PFD's are suitable only for calm weather, calm water and daylight conditions.

"The Coast Guard has failed in its mission to educate the public on PFDs," he said. Williams is lobbying for the wider dissemination of more accurate information on existing Coast Guard-approved PFDs. He also would like to see made a wider choice of approved devices, such as the marine inflatables used in Europe.

Rescue veterans are quick to point out that safety equipment alone is no guarantee of safety. They say boaters must be better educated not only in what equipment to carry, but when and how to use it properly.

"It's not uncommon for someone (in trouble) to grab a flare gun and fire off two or three flares before they realize no one is out there," said Lt. Sorensen. Coast Guard Lt. Terry Walsh, who is in charge of the Coast Guard Auxiliary in the 9th District, added, "He might not even know how to fire off his flares... I think people have forgotten that they have a responsibility for their own safety."

Boaters who heretofore purchased safety gear merely to satisfy federal law might find revealing the equipment carried by those with broad experience in maritime rescue.

Capt. Michael Stenger, chief of search and rescue in Alaska, outfits his 21-foot I/O pleasure boat there with an eye toward safety. His equipment includes float coats for his family and a Mustang suit for himself; 30 to 40 flares; two anchors, extra fuel; a VHF-FM radio, a citizens band radio, two fathometers, two fire extinguishers, a rubber inflatable, first-aid kit, spare battery, spare parts, tool kit and an auxiliary outboard engine.

"I'm a very cautious individual," Stenger said, " I plan to be totally self-sufficient if something goes wrong."

sunk by a great wind, killing four. McGeady and seven crew members then spent five days in a six-person life raft before being rescued by a Norwegian tanker.

McGeady, who now lives in Belfast, Maine, said the incident taught him a great deal about himself. It is not something McGeady wants to forget.

"I keep it in my pocket at all times," he said. "It's the most clear and simple lesson I've ever had. I don't want to lose that."

McGeady said he has learned to live more simply and confidently from the experience.

When Harry Bowman of Charleston, S.C. walks down the street now, he looks at people and wonders if they could have survived what he and Greg Bayne went through.

The two spent an unnerving night on the rail of Bayne's 26-foot centerboard yawl, which was knocked down by 15-foot seas and an army of thunderstorms 90 miles northeast of Cape Hatteras, N.C.

"I'd say that 75 percent of these people couldn't have made it through," he said.

Bowman and Bayne, like some other accident survivors, still go to sea despite hair-raising experiences that almost cost them there lives.

Six months after he'd nearly perished in Hurricane Allen, Munroe sailed back over the same area in a 19-foot boat — it was his way of getting back on the horse.

"You don't go through something like that and not come out different." he said. "I'm a better sailor as a result of it."

Dunn, who lives on a houseboat, is looking to buy a new catamaran. He said he's never been able to match the feeling of freedom he had sailing his trimaran in the Pacific.

Dower is back in Newfoundland building a new boat.

But not everyone will return to the sea. Curtis Jackson of Oxnard, CA, won't go back. He went out on his friend's 22-foot Bay-liner off Point Magu, CA, last May and nearly became a Coast Guard fatality statistic.

The boat's engine died and before the day was through, he found himself battling 25-foot seas and winds of more than 50 knots. The boat's owner and his children stayed in the cabin, seasick,

But not Jackson. He stayed on deck and kept watch. He fashioned a sea anchor from the boat's canvas to stabilize the craft in the building seas.

And he was finally able to attract a commercial fishing boat by waving a red sweater.

"I said the rest of them can give up, but I'm not," he said. "I'm not that type."

And he's not the type to tempt fate a second time. Jackson said he plans to stay ashore.

The Coast Guard Responds

The following are excerpts from a letter by R. L. Markle Chief, Survival Systems Branch, Merchant Vessel Inspection Division, U.S. Coast Guard

Thank you for the opportunity to comment on the Soundings article "Gambling on Safety Means High Stakes," regarding several incomplete statements on the value and performance of USCG approved life vests.

The issues boil down to two points. The first is the difference between what equipment is prudent to use off-shore versus in inland waters. The Coast Guard recommends only Type I personal flotation devices (PFD's) for off-shore sailing. Prudent sailors might want to carry at least two kinds of devices, Type Is and Type IIIs, as Coast Guard vessels do, for each person on board. In this way the more comfortable device could be worn for normal operations and the Type I (or some kind of survival suit, with adequate flotation) under adverse conditions. This is basically what our "Rescue and Survival Systems Manual" recommends. However it is apparent that many sailors choose not to wear flotation most of the time. Coast Guasrd crew members are required to wear one or the other type.

If there is a significant misperception about the capabilities of USCG approved life vests, we hope that the new PFD pamphlets will help to correct it. The new pamphlet that will be required on each PFD sold is much easier to read and the information should be much easier to find because the devices are described using headings such as Intended Use, Advatages and Disadvantages. Also, the devices are given descriptive names such as Off-shore Lifejacket for Type I and Flotation Aid for Type III.

Second is the issue of whether USCG approval of inflatable PFD's would improve the lot of recreational boaters. We started to approve hybrid inflatable devices in 1986. This type of inflatable has a small amount of inherently buoyant material to aid the survivor until the device is inflated or in case of inflation failure. They have not yet made a significant showing in the market. If boaters want comfortable, better performing devices, these inflatables should fit the bill. We are not yet prepared to approve fully inflatable devices because there are still reliability questions about them. Manufacturers are free to make hybrids that perform as well or better than any fully inflatable device ever made.

U.S. Coast Guard approved Type III, P.F.D. Photo courtesy of Stearns flotation wear, P.O. Box 1498, St. Cloud, MN 56302.

Satellites Answer SOS

International assistance to vessels in distress in satellite era has taken on new meaning and made worldwide headlines.

—by James T. Bailey
U.S. Program Manager,
COSPAS/SARSAT, NOAA,
Washington, DC

Joe and Jan DeJulius of Novoto, CA, heading home from Mexico late last January in their catamaran, suddenly found themselves bobbing in the ocean 160 miles off San Diego, their boat capsized in the midst of a vicious winter storm. Fortunately, when the towering wave hit they were wearing state-of-the-art survival suits or they could have perished.

Blown away from their upturned craft, they spent almost three days in the water before they could return to it and dive to recover and activate their "EPIRB" radio beacon.

While the storm still raged, Long Beach Coast Guard had reconnoitered their "abandoned" craft and seen no sign of survivors after a passing Navy aircraft carrier reported sighting it.

However, thanks to a position fix transmitted to Coast Guard Long Beach via a passing satellite of COSPAS/SARSAT, the worldwide search and rescue organization, they were rescued within two hours after their beacon went on. From the earlier aircraft carrier sighting both the Navy and Coast Guard were monitoring the "crewless craft" incident.

This success story is but one of many logged in the past six years by COSPAS/SARSAT, which since 1982 has rescued hundreds of mariners from small craft, fishing trawlers, sea-going tugs, and cargo vessels the world over.

A new day is dawning for the safety of merchant seamen — adoption of the highly successful COSPAS/SARSAT satellite search and rescue system for the world's fleet of commercial vessels. Later this year the General Assembly of the U.N.'s International Maritime Organization is expected to vote to require all commercial vessels over 300 deadweight tons to be equipped with 406 MHz emergency radio beacons. The recommendation of its Maritime Safety Committee, if adopted, would, beginning in 1989, place COSPAS/SARSAT 406 MHz beacons in all lifeboats of the world's fleet of 65,000 merchant vessels.

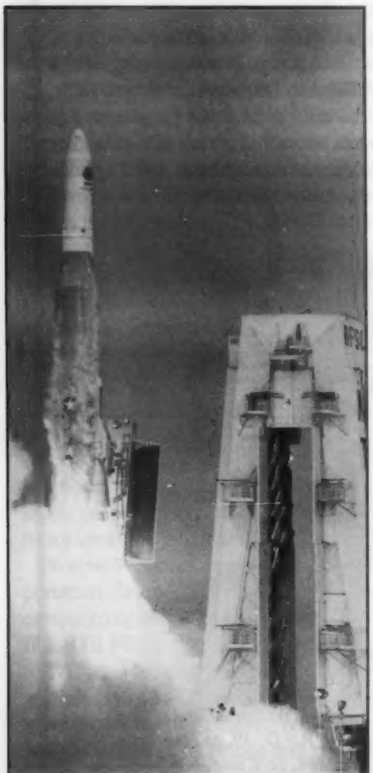
RESCUE AT SEA

Connectucut sailors, adrift in 6–foot raft, saved by Soviet–American satellite system.

By Tim Murphy

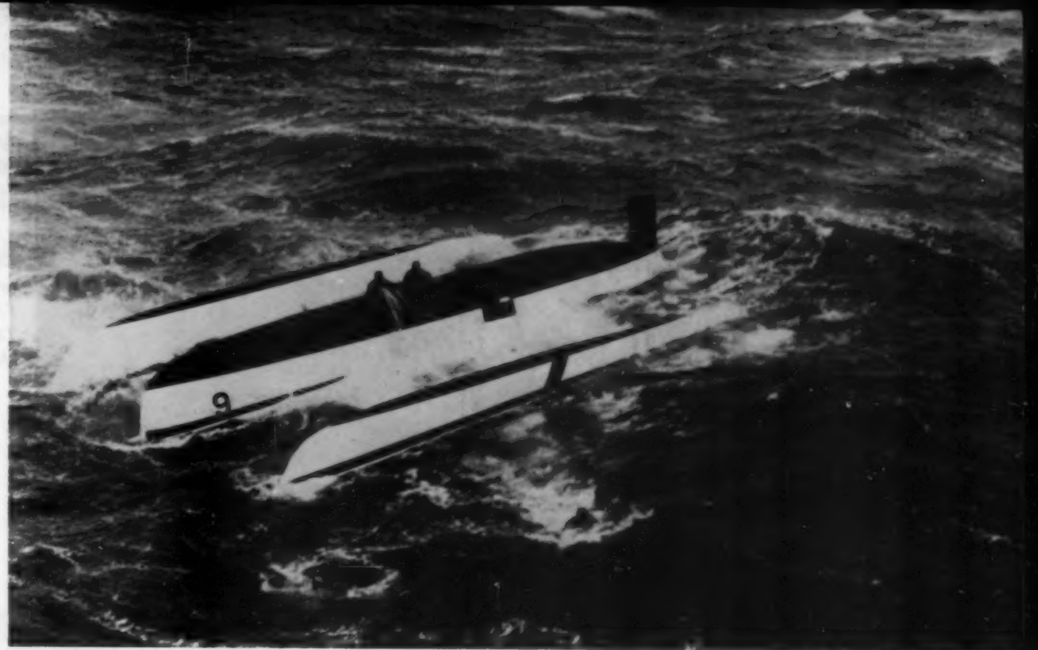
COSPAS/SARSAT is a Russian-English acronym roughly denoting satellite search for people in distress on land or sea. Its first "save" — three fliers crashed in a forest in British Columbia, Canada — was recorded Sept. 10, 1982. Exactly 5 years later, Sept 10, 1987, its 1000th "save" occurred when three crewmen from the freighter ***Freeland***, were picked up from the North Sea off the south coast of Norway.

The satellite search program, supported by three Soviet and two U.S. satellites, is one of the most cost-effective dividends of America's space program. Started by the National Aeronautics and Space Administration (NASA) as an experiment in the late 1970s, it was pioneered by Canada, France, the USSR and the United States. The U.S. portion of it has been operated by the National Oceanic and Atmospheric Administration (NOAA)



U.S. Air Force

U.S. COSPAS/SARSAT spacecraft, NOAA–G, is carried to 500–mile–high polar orbit atop an Atlas rocket in September, 1986 from Vandenberg Air Force Base, CA. A month later it assisted in the rescue of 36 crewmen from an oil tanker in the mid–Pacific. A new satellite, NOAA–H, is to be launched in July 1988.


U.S. Coast Guard

Walter Greene and his crew (also pictured in previous story) were delivering this catamaran to Europe, when it capsized in an Atalntic Ocean storm. The U.S. Coast Guard rescue vessel was alerted by COSPAS/SARSAT.

since 1983. Radio intercept instruments are piggy-backed on Soviet navigation satellites and on NOAA weather satellites. These satellites pick up distress signals from the Earth, compute the location of these signals, and then alert surface rescue teams. Nations desiring the service invest in ground facilities.

Two sea searches — one failed and one successful — 2 years apart give dramatic witness to the system's potential for saving thousands of lives and hundreds of million of dollars in rescue costs. In November, 1984, the U.S. Coast Guard, the U.S. Air Force, and a flotilla of commercial fishing vessels searched in vain off the U.S. East Coast for 2 weeks for the seven man crew of a missing fishing vessel, the ***Amazing Grace***. Although COSPAS/SARSAT satellites were circling above, evidently the vessel carried no emergency beacons that could establish a location for the ***Amazing Grace's*** lifeboats. The crew perished. Afterward, a formal investigation fixed the cost of this fruitless search at $12.5 million. By contrast, exactly 2 years later, 12 crew members of the burning 70-meter tug ***Schnoorturn*** did have portable, floatable radio beacons and they were quickly rescued, 600 miles off Acapulco, Mexico. A month earlier, in October 1986, some 890 miles west of Hawaii, 36 crew members from the burning 811-foot tanker ***OMI Yukon*** had been rescued from lifeboats, thanks to satellite position signals.

In 1987 the Soviet Union became the final signatory to an agreement establishing a world COSPAS/SARSAT headquarters, with its operating expenses shared by participating nations. Daniel

Space–age rescue system crosses cold–war lines

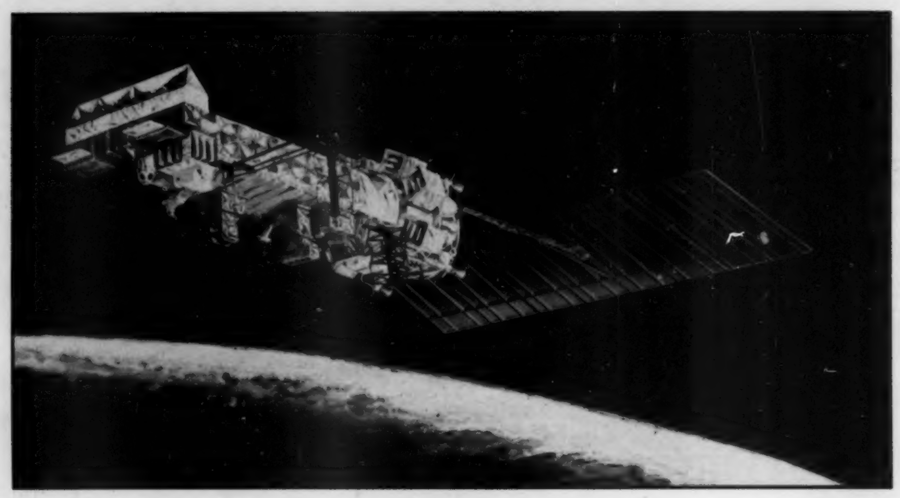
Satellites speed sea, land searches

Now, signals from distress bea intercepted by orbiting satellit to local stations on land, which

Levesque, of Paris, formerly of the French Space Agency (CNES), heads up a new office which is co-located with the International Maritime Satellite Organization (INMARSAT) in London. In 1987 the USSR installed a new ground station at Novosibirsk to link up with existing Soviet stations at Moscow, Archangel, and Vladivostok. Canada completed three new ground stations in 1987 at Edmonton, Alberta, Churchill, Manitoba and Goose Bay, Labrador. It already has a station at Trenton, Ontario. Brazil was scheduled to have a fully operational station; the first below the equator. Chile has had an experimental station for the past year. Other stations already in operation are Lasham, UK, Tromso, Norway, Toulouse France; and in the United States, Kodiak, AK, Point Reyes, CA, and Scott Air Force Base, IL.

The Japanese government's Maritime Safety Agency has begun testing the new 406 MHz system and an agreement is circulating in India for that country's construction of a ground station. Other nations exploring active participation include Argentina, Australia, Peoples' Republic of China, Italy, South Korea, Spain, Sweden, Denmark and Switzerland.

The U.S. Department of Commerce is well along toward construction of a sophisticated new Mission Control Center at NOAA's satellite operations center at Suitland, MD. By 1990 NOAA is expected to take over from the United States Air Force mission control responsibilities now centered at Scott Air Force Base. It is expected that 406 MHz beacons will



Search and rescue satellite (left) patrols a polar orbit. James Bailey, the author, is the U.S. manager of COSPAS/SARSAT, while the Mission Control Center (bottom) is presently located at Scott Air Force Base near St. Louis, MO. The setup in a nutshell is shown at right.

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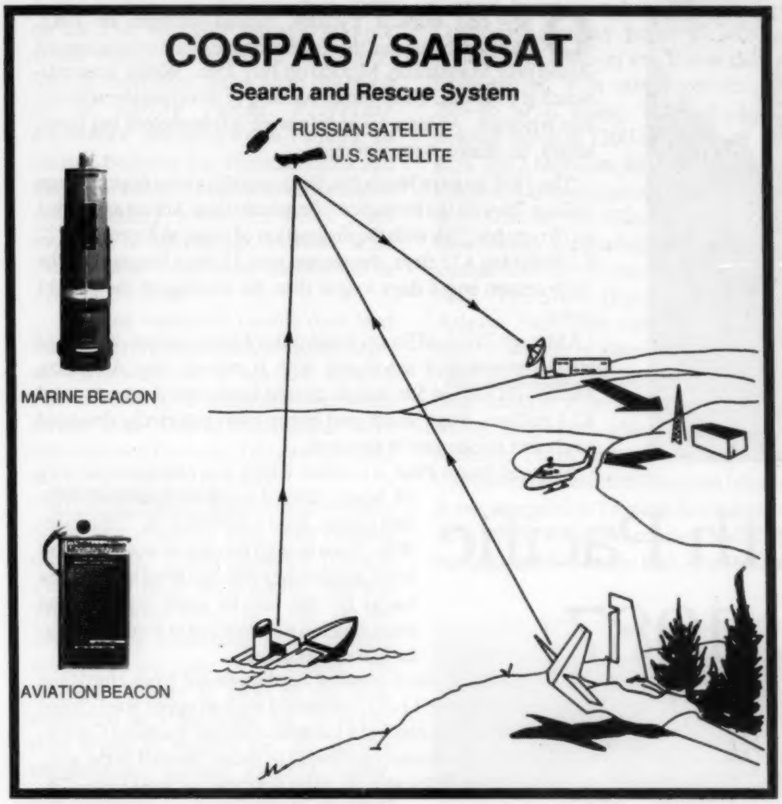
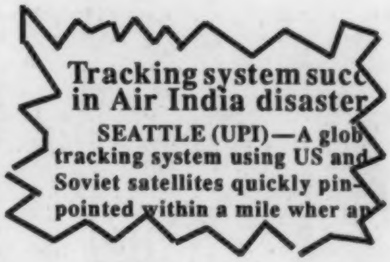
be mandatory on the U.S. fleet of 33,000 fishing vessels. Action awaits certification by the Federal Communications Commission (FCC) of the safety of the new design beacons. Already the system has been instrumental in saving more than 130 fishing vessel crewmen in the Arctic, Pacific, Mediterranean and the North and South Atlantic.

NOAA and NASA are exploring the potential for a complementary early-warning instrument aboard NOAA's high altitude geostationary (GOES) satellites. In February 1987 a test instrument was launched aboard NOAA's newest GOES spacecraft, GOES-H, from Cape Canaveral, FL. When fully operational this instrument is expected to flash an instantaneous signal to ground stations that a beacon has been activated. This will provide advance notice of an emergency before the COSPAS/SARSAT lower altitude spacecraft have passed over the distress site.

The system is composed of three main subsystems: the emergency beacons, the COSPAS or SARSAT satellite with repeaters/processors and the ground stations. These components can be used in two different coverage modes for the detection and location of the emergency beacons operating in three frequency bands — 121.5, 243 and 406 MHz. The system has both regional and global coverage modes. COSPAS/SARSAT uses multiple satellites in low, near-polar orbits "listening" for distress transmissions beamed from emergency beacons on the ground into space. The signals received by the satellites are relayed to a network of Local User Terminals (LUTs) ground stations — where the location of the emergency beacon is determined by measuring the Doppler shift caused by the motion of the satellite (with its precisely known orbit) and the position of the beacon emitting the distress signal. The location data is then relayed to the Mission Control





Tracking system succ
in Air India disaster

SEATTLE (UPI)—A glob tracking system using US and Soviet satellites quickly pin-pointed within a mile wher ap

NOAA

Center (MCC) closest to the emergency site, which in turn alerts the appropriate Rescue Coordination Center (RCC). A team from the nearest RCC then begins the actual search and rescue operation in accordance with conventional practice.

Frequency of coverage is dependent on the number of satellites in orbit. It also is latitude-dependent with more frequent coverage at higher latitudes. When four search and rescue equipped satellites are in operation at the same time, distress signals will be detected within two hours, on the average. In the spacecraft, a repeater data system relays in real time 121.5, 243 and 406 MHz signals. In addition, when 406 MHz signals are received, an onboard signal processor preprocesses and records the data for transmission to the ground at a later time in the playback mode. The playback mode provides global coverage. The global coverage mode provides full-Earth coverage by storing data in the spacecraft until it is transmitted down at the next available ground station. This enables all areas out of range of ground stations to be covered. This mode, however, only operates with the 406 MHz distress signal units.

The 406 MHz system relies on beacons specifically designed to take advantage of the satellite detection system. The higher power and improved frequency stability of the 406 MHz units have a greater performance capability than the 121.5/243 MHz system. The probability of detection of normally transmitted signals is much greater and the location accuracy is 2 to 5 kilometers (1.2 to 3.1 miles). A 406 MHz data processor is carried on both the COSPAS and SARSAT spacecraft. Other significant advantages of the 406 MHz system includes distinguishing whether the signal is from an aircraft or vessel, its country of origin, the nature of the distress, the registration number of the vessel or aircraft and even, if known, the directly encoded location of the emergency. This is in addition to the location derived from normal Doppler processing. This additional information is of great value in using a geostationary satellite for relaying beacon signals, because the geostationary satellite does not provide Doppler location.

The first 406 MHz system save occurred a year ago on May 27, 1987, after nine French expedition members, who experienced heavy weather on the Greenland ice cap, activated their 406 MHz distress beacon. A COSPAS/SARSAT satellite picked up their signal and relayed it to the Mission Control Center (MCC) in Toulouse, France. The MCC calculated the exact position of the beacon and transmitted it to the Danish Rescue Center in Sondestrom, Greenland which sent rescue aircraft to the expedition. Prior to that "save" the rescues were made via the 121.5 MHz frequency.

Only one tropical cyclone moved onshore in 1987. Hurricane Eugene, the first hurricane of the season moved inland near Manzanillo, Mexico on July 25th. Winds were estimated at 85 knots. Widespread flooding of this coastal resort city was reported. At least 60 people were left homeless but fortunately, no deaths were reported.

The 1987 Eastern North Pacific tropical cyclone season began on June 7th with the formation of tropical storm Adrian and ended on November 25th with the dissipation of tropical depression 22 E. Spanning 171 days, the season was 15 days longer than the 1986 season and 8 days longer than the average of the past 11 years.

Although Tropical Storm Irwin did not move ashore, an area of intense convection associated with it moved over Acapulco, Mexico on August 5th, which caused losses worth an estimated $2.1 million. High winds and heavy rains reportedly damaged roads and businesses in that area.

Eastern North Pacific Hurricanes, 1987

There were 22 tropical cyclones during 1987 – four fewer than the record set in the 1982 season. The 1987 season was the sixth consecutive with 22 or more storms.

– by Roger L. Cross
Eastern North Pacific Hurricane Center
San Francisco, CA

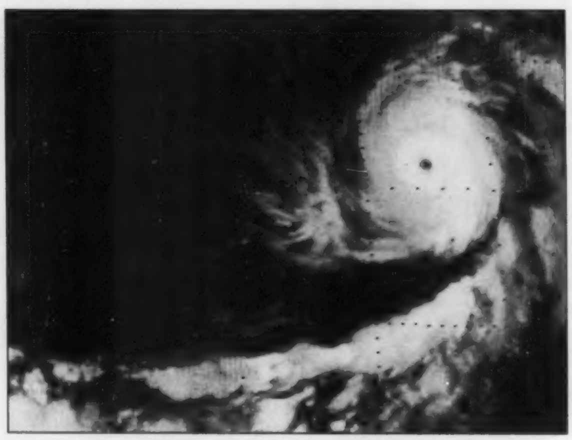
Tropical Storm Pilar, a cyclone which was classified for only 24 hours, moved northward toward Cabo San Lucas, Baja California on September 30th. Even though this storm was very short lived, an observer who has lived in Cabo San Lucas for the last 18 years reported that more rain fell with this storm than any other, he had encountered.

The moisture which sheared northeastward from Hurricane Ramon on October 11–12, interacted with an upper level closed low, which moved eastward towards extreme southern California. Ramon's moisture contributed to record rainfall in the area. Near Mt. Palomar, located 16 miles northeast of San Diego, CA, a brush fire which raged out of control for more than a week was brought under control by the rainfall. In addition, high winds toppled trees in some areas of San Diego, and some mudslides were reported around Mt. Palomar.

(A brief summary of the tropical cyclones that reached hurricane intensity follows (all times are GMT, now known as UTC).)

Hurricane Eugene moved into the Pacific from Nicaragua as a disturbance on July 20th. Moving westward the disturbance was upgraded to a depression at 0000 on the 22d and immediately began to veer north northwestward. It was upgraded to Tropical

A week-long October brush fire (above), near Mt. Palomar, CA was quenched by rains enhanced by moisture from Ramon. The hurricane of the season was Max (right), with record-setting 135-knot winds. Photo courtesy of the U.S. Forest Service, Cleveland National Forest.



Storm Eugene later that same day. Late on the 23d, ship HF7 reported 40-knot winds within 150 miles of the center. Shortly thereafter, gales were observed by the ***Spring Panda, Professor Khromov*** and the ***Exxon Valdez***, all located between the Mexican coast and the storm center. Eugene reached hurricane intensity some 215 miles south southeast of Manzanillo, Mexico. It hit the Mexican coast near Manzanillo at 1200 on the 25th.

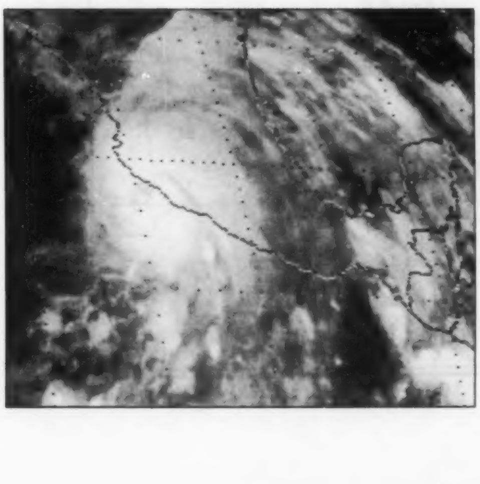
Eugene weakened rapidly over land but kept its organization and moved north northwestward out to sea just west of Puerto Vallarta. It dissipated over water on the 26th. Useful observations were also received from the ***Strider Isis*** and the ***Vermilion Highway***.

Hurricane Greg began as an easterly wave, which moved west from Panama on July 26th. It was classified Tropical Depression 10, at 0000, on the 28th and Tropical Storm Greg by 1200 on the 29th. Greg intensified while moving northwestward over 29°-C waters. He reached intensity at 1800 on the 31st, continued as a hurricane for 24 hours, then began to weaken as sea surface temperatures became steadily colder. The remnants of Hurricane Greg dissipated over 22°-C water at 1800 on the 3d of August. The ***Pacific Teal, Sunbelt Dixie, Pacific Victory Philippine Laurel, Atigun Pass, Jo Oak***, and the ***Exxon Washington*** all made valuable observations while in the vicinity of Hurricane Greg.

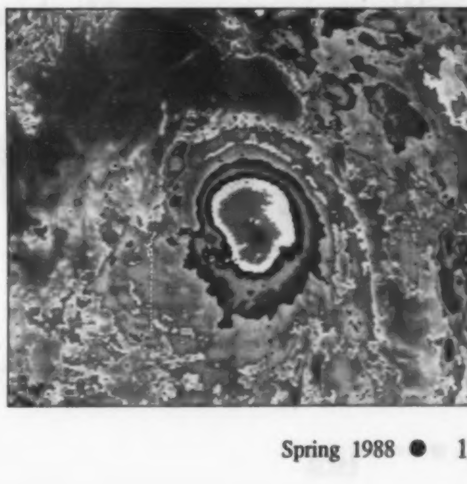
Hurricane Hilary formed out of a tropical wave, which moved through Central America on July 30th and 31st. Convective activity began to increase rapidly after 0000 on the 31st as the cyclone moved west northwestward over 29°- to 30°-C water. Hilary became a tropical storm at 1200 on the 1st of August, and a hurricane 24 hours later. She reached maximum intensity of 105 knots at 0000 on the 4th. This was followed by slow, steady weakening until Hilary dissipated over 21°-C water at 0600 on the 9th. The ***Shen Quan Hai*** and the ***Atigun Pass*** sent useful observations early in the life of Hurricane Hilary.

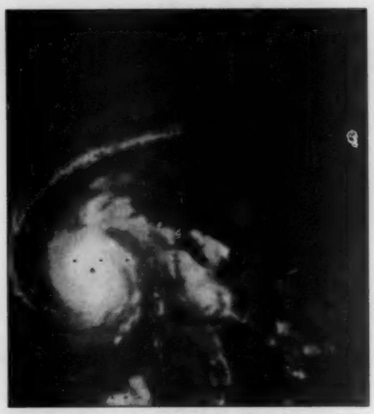
Hurricane Jova formed in August in deep easterly flow to the south of the strong, deep ridge, which extended from southern Texas through southern Baja California and on to the Hawaiian Islands. It was upgraded to Tropical Storm Jova at 1200 on the 14th and reached hurricane intensity at 1800 on the 16th. By 1800 on the 17th maximum winds around Jova had reached 90 knots over an area of 26°- to 27°-C water. Hurricane Jova continued westward and was transferred to the CPHC in Honolulu at 0000 on the 20th. NOAA ship ***McArthur*** shadowed Jova for a number of days and took many useful observations. Valuable observations were also received from the ***Moku Pahu*** and the ***Pacific Crane***.

Hurricane Lidia began as a tropical wave which passed into the Pacific from Central America on the 28th. This disturbance moved rapidly westward over the warm waters south of Salina Cruz, Mexico. It was upgraded to Tropical Storm Lidia at 0000 on the 30th, and reached hurricane intensity by 0600 on the 1st of September. At that time, the circulation around Lidia was defined very well by observations sent by the ***Vyssotsk*** and the ***Alexandre Serafimoritch***. Just 6



The usually placid Manzillo (top) is about to be clobbered by Eugene (left) on the 25th of July. An enhanced view of Hillary was snapped on the last day of August.





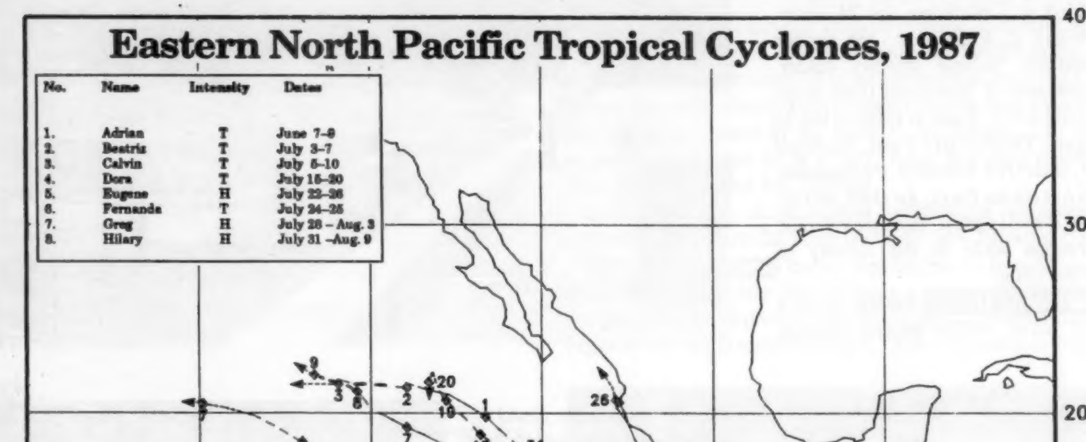
On the 22d of September, Otis was spotted southwest of Baja California, sporting winds of 100 knots. At this time Otis was moving toward the northwest and he maintained hurricane intensity until the 25th.

hours later according to Dvorak wind estimates, winds around Lidia peaked at 75 knots. A fairly rapid weakening trend followed, and Lidia dissipated over 25°-C water on the 3d.

On September 8th, a tropical disturbance, which was to become Hurricane Max moved westward from Central America, and intensified over the warm waters south of the Gulf of Tehuantepec. As a depression it intensified rapidly and was named Tropical Storm Max at 0000 on the 10th. Thirty hours later Max became a hurricane. By 0600 on the 13th the Dvorak satellite wind estimate reached T number 7 or 135 knots. This is the highest wind recorded for any Eastern Pacific hurricane since satellite wind speed estimates have been available. This intensity was maintained for 24 hours. Then Max reached the 26°-C water and began to weaken rapidly. Useful observations were received from the ***Gavriil Derjavine, C S Fortune*** and the ***David Starr Jordan*** while they were in the vicinity of Hurricane Max.

Hurricane Norma began as a tropical disturbance about 300 miles southwest of Acapulco, Mexico on the 13th September. With steady intensification over 28°-C water. Tropical Depression 17 became a tropical storm at 1800 on the 15th, and a hurricane by 1200 on the 19th, as a small eye became apparent in infrared satellite imagery.

Norma then turned northward at 5 knots and passed about 180 miles west of Cabo San Lucas on the 19th. At that point it appeared that Norma would move inland, but instead, the storm stalled off the west coast of Baja California south of Santa Margarita Island, and dissipated over 25°-C water. Even though the storm center dissipated over water, an associated area of intense convection moved inland on the 19th. The area is sparsely populated and no reports of flooding or damage were received. Very useful observations were received from the ***Pioneer Leader*** and the ***Tineke***.



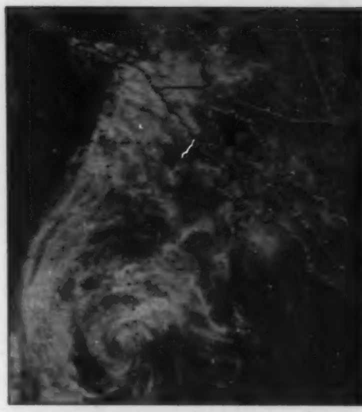
Hurricane Otis, 18th tropical cyclone of the season, developed very slowly as a disturbance along the ITCZ. This disturbance moved westward over the waters south of the Gulf of Tehuantepec between the 17th and 19th of September. It turned northwestward and intensified rapidly over 28°-to 29°-C water. At 1800 on the 20th, it was named Tropical Storm Otis, then increased to hurricane intensity just 18 hours later.

As Otis moved westward, the wind speed increased to 100 knots by 0600 on the 22d and maintained that intensity most of the time during the next 2 1/2 days. Then, late on the 24th, Otis began to accelerate westward and finally weakened over 26°-C water.

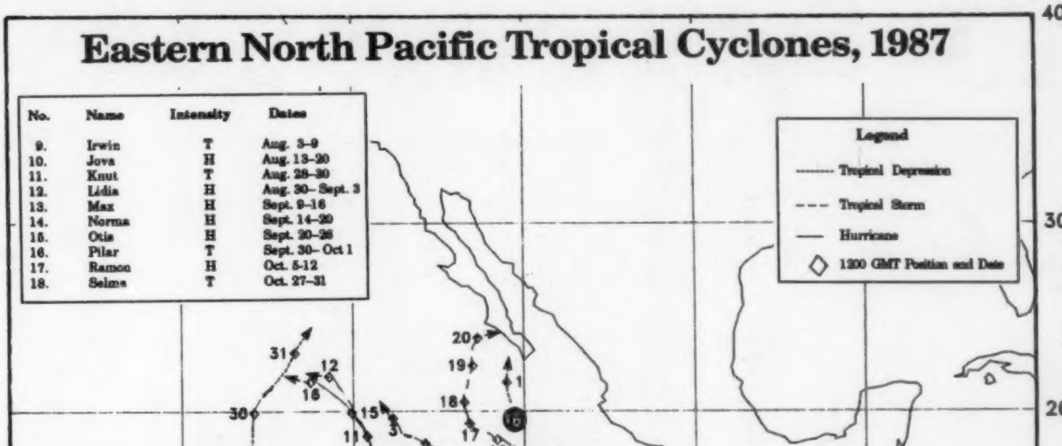
Hurricane Ramon was first detected on the 3d of October as a tropical disturbance beneath a deep layer, mean high centered in central Mexico. The disturbance became increasingly organized as it moved westward over 28°-C water. At 1800 on the 5th, the ***Nedlloyd Van Noort*** reported 35-knot winds and high seas about 100 miles north of the storm center and this system was upgraded to Tropical Storm Ramon, some 500 miles southwest of Acapulco.

Ramon turned west northwestward and intensified to hurricane intensity by 1200 on the 7th. At 0600 on the 9th, Ramon peaked in intensity with 115- knot winds. Winds remained above 95 knots until 0600 on the 11th. Then the storm weakened rapidly as it interacted with a subtropical jet stream and increasingly colder water.

Ramon dissipated at 0600 on the 12th, however copious moisture was transported from the storm environment by the subtropical jet stream northeastward into southern California. This moisture fed a storm center in the westerlies and contributed to record rainfall in extreme southern California. Ship JA4 sent a series of useful observations while in the vicinity of Hurricane Ramon.



Notice the circulation of Ramon stretching to the northeast, into Southern California on the 11th of October. It was this moisture which enhanced an upper-level system that produced rain showers, which were benefical to the area northeast of San Diego,CA.



Eastern North Pacific Tropical Cyclones

Year	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Tot
1966	0(0)	1(1)	0(0)	4(4)	6(2)	2(0)	0(0)	0(0)	13 (7)
1967	0(0)	3(1)	4(0)	4(2)	3(1)	3(2)	0(0)	0(0)	17 (6)
1968	0(0)	1(0)	4(0)	8(3)	3(2)	3(1)	0(0)	0(0)	19 (6)
1969	0(0)	0(0)	3(1)	2(1)	4(1)	1(1)	0(0)	0(0)	10 (4)
1970	1(1)	3(0)	6(1)	4(1)	1(0)	2(1)	1(0)	0(0)	18 (4)
1971	1(1)	1(1)	7(5)	4(2)	2(2)	2(1)	1(0)	0(0)	18 (12)
1972	1(1)	0(0)	1(0)	6(6)	2(1)	1(0)	1(0)	0(0)	12 (8)
1973	0(0)	3(1)	4(3)	1(0)	3(2)	1(1)	0(0)	0(0)	12 (7)
1974	1(0)	3(2)	3(2)	6(4)	2(2)	2(1)	0(0)	0(0)	17 (11)
1975	0(0)	2(1)	4(2)	5(3)	3(1)	1(1)	1(0)	0(0)	16 (8)
1976	0(0)	2(2)	4(1)	4(2)	3(3)	1(0)	0(0)	0(0)	14 (8)
1977	1(0)	1(0)	1(1)	1(1)	1(1)	1(1)	0(0)	0(0)	8 (4)
1978	1(1)	3(2)	4(3)	6(4)	2(1)	2(1)	0(0)	0(0)	18 (12)
1979	0(0)	2(1)	2(1)	2(2)	1(1)	2(1)	1(0)	0(0)	10 (6)
1980	0(0)	3(2)	5(2)	2(2)	2(1)	2(0)	0(0)	0(0)	14 (7)
1981	1(0)	1(1)	3(1)	4(3)	2(1)	4(2)	0(0)	0(0)	15 (8)
1982	1(0)	1(0)	6(4)	5(3)	4(3)	2(1)	0(0)	0(0)	19 (11)
1983	1(1)	1(1)	6(2)	3(2)	5(3)	2(2)	1(0)	0(0)	21 (12)
1984	2(1)	3(3)	3(2)	4(2)	4(4)	2(0)	0(0)	0(0)	18 (12)
1985	0(0)	5(2)	7(1)	4(3)	4(3)	2(2)	0(0)	0(0)	22 (11)
1986	1(1)	2(1)	3(2)	5(1)	5(3)	1(1)	0(0)	0(0)	17 (9)
1987	0(0)	0(0)	7(3)	4(2)	4(3)	2(1)	0(0)	0(0)	17 (9)
Tot	12(7)	41(21)	87(37)	88(53)	68(41)	42(21)	6(0)	1(0)	345(182)
Avg	0.6(0.3)	1.9(1.0)	4.0(1.9)	4.0(2.4)	3.0(1.9)	1.9(1.0)	0.3(0)	.05(0)	15.7(8.3)

Figures in parentheses represent tropical cyclones that have reached hurricane intensity. Tropical cyclones are ascribed to the month in which they began.

Central North Pacific Tropical Cyclones, 1987

Just two native storms roamed these waters in 1987. Two others were invaders from the east.

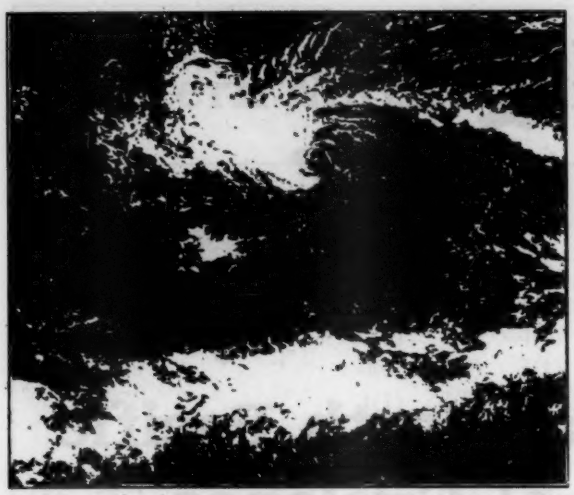
– by Hans Rosendal and Andrew Chun
Central Pacific Hurricane Center, Honolulu, HI

The central North Pacific was the scene of three tropical storms and one hurricane. Hurricane Peke and tropical storms Oka developed in these waters (between 140°W and the Dateline). The others invaded the areas from the east.

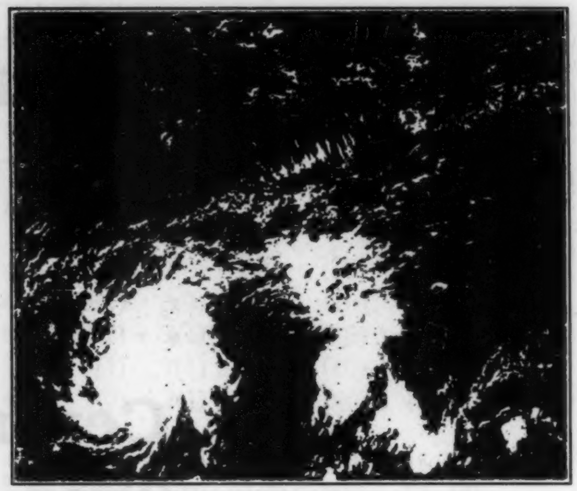
Tropical Storm Fernanda crossed 140°W and moved into the Central Pacific Hurricane Center's area of responsibility on July 26th at 0000. This system developed farther west than normal for eastern Pacific tropical cyclones. Fernanda appeared to be in a location favorable for further intensification and movement toward the Hawaiian Islands. This, however, was not to be. A trough in the upper level flow to the northwest of Hawaii was moving southeastward while Fernanda was moving steadily west northwestward. The unfavorable environment created by the closing upper trough began to have its effects on Fernanda by the 26th. The storm failed to intensify and showed signs of becoming sheared and elongated in a northeast/southwest direction. Maximum intensity was estimated at 55 knots on the 26th when she was about 900 miles to the east southeast of Hilo. Air Force reconnaissance flying into the storm on the 27th, verified previous estimates of maximum winds. Fernanda continued to weaken and at 1800 on the 18th was downgraded to a tropical depression.

Tropical Storm Jova entered the Central Pacific Hurricane Center's (CPHC) area of responsibility on August 20th at 0000 in a state of declining intensity. Jova was already a week old and had been a hurricane with maximum sustained winds estimated at 90 knots. The weakening tropical storm crossed 140°W with maximum sustained winds estimated at 45 knots and moved westward, roughly following latitude 15°N with a rapid forward speed of 20 knots. Jova continued to weaken and was downgraded to a tropical depression at 1800 on the 20th. The last advisory on Jova was issued at 0000 on the 22d as the dissipating tropical depression passed about 300 miles south of South Point, Hawaii. The remnant circulation moved westward for several more days and was still discernible to the south of Johnston Island on the 24th.

Tropical Storm Oka developed from Tropical Depression ONE-C, the first tropical cyclone to form in the central



Tropical Storm Fernanda is spotted on the 26th of July, sporting maximum winds of 55 knots near her center, which was some 900 miles east southeast of Hawaii.



At 2345 on August 27th, Tropical Storm Oka, far to the south of Hawaii, is generating 50–knot winds.

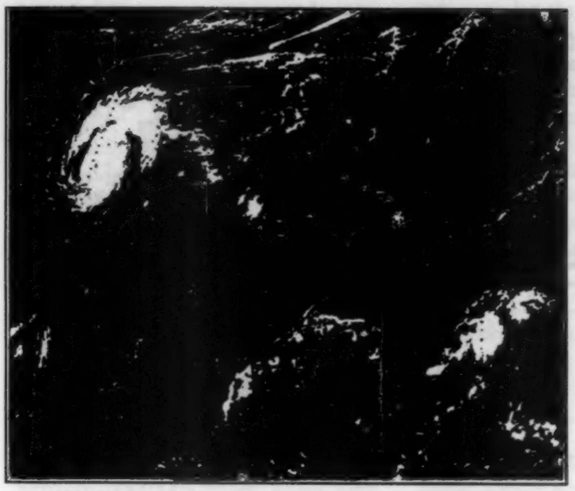
North Pacific during the 1987 season. He developed far to the south out of a disturbed area along the ITCZ on August 25th, with several ships in the vicinity reporting squally weather and southwesterly winds. At 1200 on the 26th, the strengthening cyclone was upgraded to a tropical storm and named Oka (Hawaiian for Oscar). Oka remained far to the south of the Hawaiian Islands, as it moved slowly west northwestward and intensified. Maximum sustained winds were estimated at 50 knots on the 27th. On the 28th, Oka began to feel the effects of troughing in the upper flow to the northwest and started a rapid decline in intensity. At dawn on the 29th, the first visual satellite picture of the day indicated that he was dissipating rapidly. The moribund tropical storm was downgraded to a tropical depression and the last advisory was issued at 1800 on the 29th.

Hurricane Peke was the second tropical cyclone of the 1987 season to form within the Central Pacific Hurricane Center's area of responsibility. Warmer than normal sea surface temperatures, associated with what has been referred to as the "El Nino", were present south of Hawaiian Islands extending to the equator and beyond. Warmer than usual waters, together with the subtropical high pressure system being farther north and west than normal, helped induce an east-west trough which extended across near equatorial latitudes from the perpetually warm western Pacific. Light winds and high humidity thus prevailed over the region usually dominated by moderate trades. Cyclones within this portion of the North Pacific are far removed from areas farther east and west that normally possess conditions much more favorable for tropical cyclone genesis.

A cloud cluster was already evident on September 15th, in the satellite pictures over the waters to the south of the Hawaiian Islands, within the trough near 10°N 155°W. There were also frequent reports from ships, among them the vessel ***Nedlloyd Katwijk*** of westerly winds to the south of this active convection. This convective area drifted slowly westward over the next few days, and by the 21st a closed circulation had developed. A few hours later, at 0000 on the 22d it was determined that the winds were tropical storm strength and the system was named Peke, the Hawaiian name for Becky. As Peke, intensified, she moved along a northwesterly and later northerly track. Satellite intensity estimates at 1800 on the 22d indicated maximum sustained winds at 75 knots.

It soon became apparent that Peke was very reluctant to cross the Dateline and instead drifted slowly northward along the 178°W meridian between 13°N and 23°N at about 5 to 10 knots, with winds reaching a maximum of about 90 knots. From the 23d through the 26th, Peke remained over 28°-C (82°F) or warmer waters, which helped her maintain hurricane intensity despite the northerly latitude. Finally on the 27th, at about 2000, the center of Peke appeared to cross the International Dateline near 24°N, generating winds estimated at 85 knots. The CPHC passed the warning responsibility for Peke to the Joint Typhoon Warning Center (JTWC) on Guam at this time.

For several more days, Typhoon Peke remained large and vigorous just west of the dateline. The JTWC issued its last advisory for Peke at 1500 on the 3d when her remains were 400 miles west of Midway Island. A remnant circulation, within which ships encountered near gale force winds, persisted for another 5 or 6 days near the Dateline before finally moving out of the tropics in a northeasterly direction across the Midway area on October 8th. There were no known ship casualties associated with Peke. The islands of Wake and Midway only received fringe effect such as high surf on Wake. Gusty winds and heavy rain squalls hit Midway and the other atolls and islets on the western end of the Hawaiian Island chain.

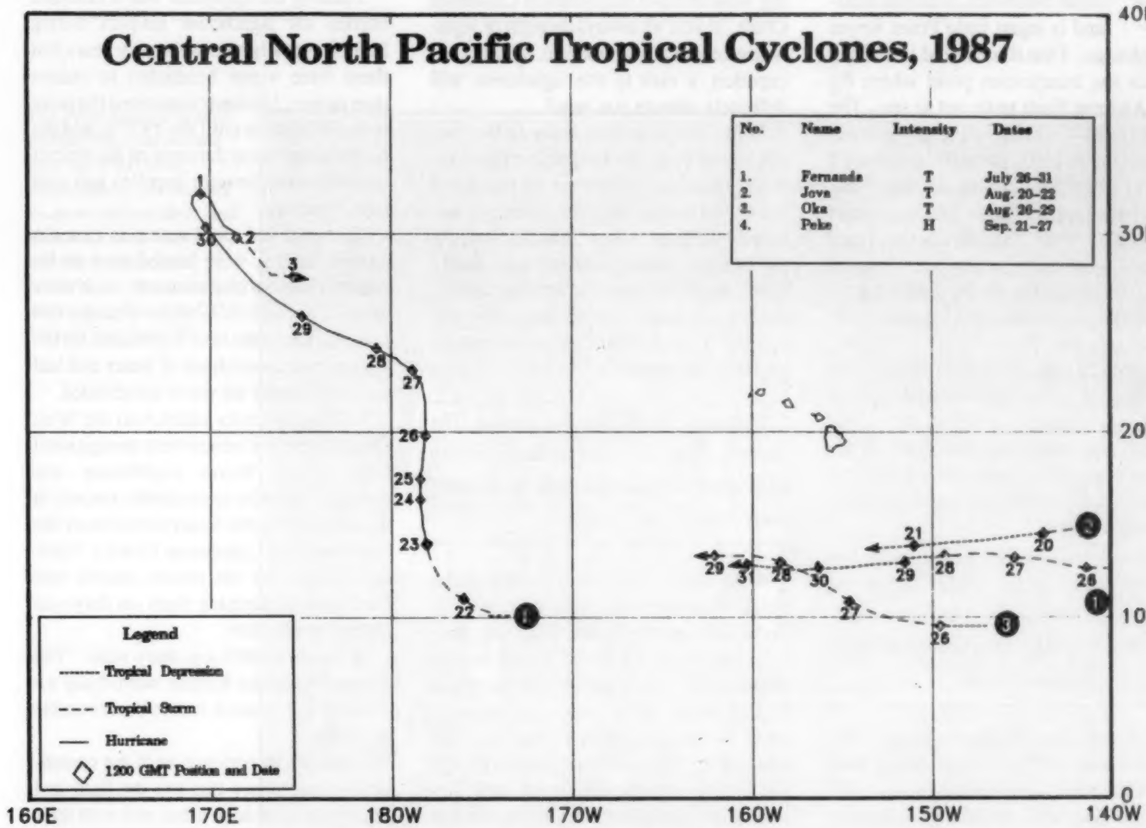


Typhoon Peke, the ex hurricane, is generating 80–knot winds at 0015 on September 28th, a few hours after crossing the International Dateline.

Central North Pacific Tropical Cyclone Data, 1987

No.	Name	Dates	Class	Maximum Sustained Winds (kn)
1	Fernanda	Jul 26-31	TS	55
2	Jova	Aug 20-22	TS	45
3	Oka	Aug 26-29	TS	50
4	Peke	Sep 21-17	H	90

H Hurricane
TS Tropical Storm
TD Tropical Depression



Whale Oil and Wicks

—by Elinor DeWire
152 Osprey Dr.
Groton, CT 06340

Perched 300 feet above the Pacific Ocean on a bold California headland is squat little Point Reyes Lighthouse. First illuminated in 1870, it guards the treacherous point where the San Andreas Fault trails out to sea. The West Coast's first known shipwreck occurred here in 1595, and so frequent were wrecks after the Gold Rush, San Francisco newspapers kept heading slugs ready that read "Shipwreck at Point Reyes."

The station also holds the distinction of being both the windiest and foggiest lighthouse on the West Coast. Winds, averaging 23 mph, continuously scour the promontory. (One clear-weather gust in 1895 was clocked at 93 mph!) Fog shrouds the area about one-third of the year as well, rolling and churning over the jagged headland almost daily during the summer months.

'If you've always thought of lighthouse keeping as a romantic, relaxing occupation, a visit to this lighthouse will definitely change your mind.'

Point Reyes Lighthouse is now unmanned and operates an automatic beacon. One of the highlights of Point Reyes National Seashore, its history is among the most fascinating of the Old Lighthouse Service—a grueling saga of hardship and adversity set against the sprawling wilderness of the Northern California Coast. If you've always thought of lighthouse keeping as a romantic, relaxing occupation, a visit to this lighthouse will definitely change you mind.

Some 308 steps lead down to the beacon tower from the keepers' residences, and it's another 338 steps to the fog signal house. During the last century, one keeper suffered a heart attack climbing the blustery stairs; another was nearly killed when the cablecar hauling coal to the foghouse snapped its line, went careening down the staircase, and smashed into the lighthouse.

'A January 1889 Log entry read: 'The Second Assistant Keeper went crazy today and was handed over to the constable at Olema'.'

Wind has always been a hazard on the point. Keepers were often marooned in the lighthouse for hours, knowing they might be blown off the cliff were they to venture out. Sand stung their faces and frosted windows; it kidnapped laundry from the clothesline and shredded the station flag. One windy night a keeper left his bed to assume the watch and was nearly impaled when a splintered timber hurled through his window, snared the bedsheet, and pinned it to the opposite wall!

Battling the elements was a constant burden for lighthouse keepers during Point Reyes Lighthouse's early years, but there were worse headaches to endure than nature. No roads connected the point with civilization until the 1930's, and the only visitors were the crew of the district tender, which brought supplies and coal to the keepers.

Firewood and extra water, in case the cistern ran dry, were hauled over an Indian trail from a distant ranch. As if there weren't enough difficulties already, this task also tested the men's fortitude, for the station mule was afraid of water and had to be led across the point blindfolded.

Not long after its addition to the West Coast's string of benevolent navigational aids, Point Reyes Lighthouse was deemed "the most undesirable (station) in the district" by the Superintendent of the San Francisco Lighthouse District. Finding keepers for the remote station was hard enough; keeping them on duty was almost impossible.

A January 1889 log entry read: "The Second Assistant Keeper went crazy today and was handed over to the constable at Olema."

Keepers lost patience with the cantankerous machinery that ran the light and fog signal, with each other, and with their families. There was constant bickering, aggravated by the eternal din of the fog-

horns and the ever-present fog and winds.

One disconcerted keeper was prompted to pen this poem:

O Solitude where are thy charms that
Sags have seen in thy face.
Better to dwell in the midst of alarms
Than reign in this terrible place.

redwoods, but the wives of Point Reyes' light keepers only noticed it made their complexions softer.

One West Coast historian comically points out that even if adults did not enjoy life at Point Reyes, children did. A favorite amusement was riding down the precipitous coal chute in a box slathered with axle grease. Another was trying to slide down the steep stair rail to the lighthouse without touching your feet to the steps.

"... Point Reyes Lighthouse children were sure-footed as mountain goats, and they swam like menfolk in the point's surf, which is estimated to be the roughest on the California Coast."

Not all was dreadful at Point Reyes, however. California poppies set the headland ablaze with color during the warmer months, and gray whales surge past the point in winter on their way to warmer breeding grounds to the south. The persistent fog, botanists remind us, brings vital moisture to California's majestic

With all the steep rocks to play on, Point Reyes Lighthouse children were sure-footed as mountain goats, and they swam like menfolk in the point's surf, which is estimated to be the roughest on the California Coast. They learned to take their naps and concentrate on their studies with the loud bellow of foghorns in the background. One lighthouse mother noted that her baby's first words were not the usual "mama" or "dada," but the resounding "beeeee-oooohhhh" of the Point Reyes fog signal.

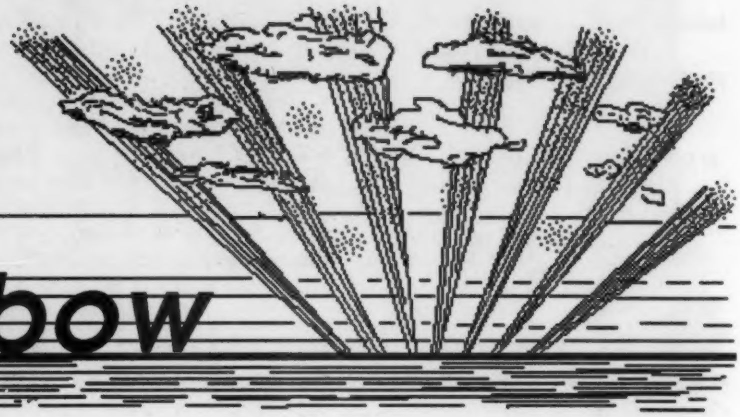
Many changes have occurred at Point Reyes Lighthouse since its inception into service in 1870. For one thing, the fog signal has been moved a few times to compensate for the cliff's dead spots and odd acoustics, and it now operates electrically rather than gobbling 80-tons of coal a year as it did a century ago.

Although the original French lens is still in place, illuminants have kept pace with progress. Lard oil was used initially, followed by an oil vapor light in 1877, and finally electricity in the 1930's. The sentinel was also a Weather Station from 1900 to 1927 and had a radiobeacon installed in 1949. The titanic lens, with its 1000-plus glistening prisms, was retired in 1975 and replaced by a more modern beacon on the roof of the sentinel.

The Point Reyes/Farallon Islands National Marine Sanctuary has been established to protect and preserve marine birds and mammals, their habitats and other national resources in the waters surrounding the Farallon Islands and Point Reyes.

U.S. Coast Guard

beyond the rainbow



William R. Corliss
P.O. Box 107
Glen Arm, MD 21057

"Unusual Natural Phenomena at Sea"

As the sun sinks toward the horizon, the longer path that sunlight must travel through the capricious atmosphere results in images of terrestrial and astronomical objects, which may become grotesquely distorted, multiplied and painted with unlikely hues.

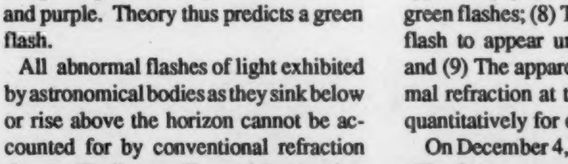
The bending of light waves (optical refraction) by the different layers of air creates this type of magic. Still closer to the horizon, clouds and mountain peaks intercept and further alter the sun's rays, giving rise to the well known, fan–shaped crepuscular rays, as well as more exotic phenomena. One optical phenomenon at work is that of dispersion, which spreads out the spectral colors of sunlight. The famous "green ray" or "green flash" is due to atmospheric dispersion.

Most scientists portray the green flash as an easily explained atmospheric phenomenon. As the sun sinks below the western horizon, the tip hanging on the horizon turns green for an instant because the refractive power of the atmosphere spreads (disperses) the spectral colors vertically so that the shorter wavelengths are the last to be seen. Green, blue, and finally purple (violet) should appear in sequence. In practice, the complete succession of colors is rare because the atmosphere preferentially scatters the blue and purple. Theory thus predicts a green flash.

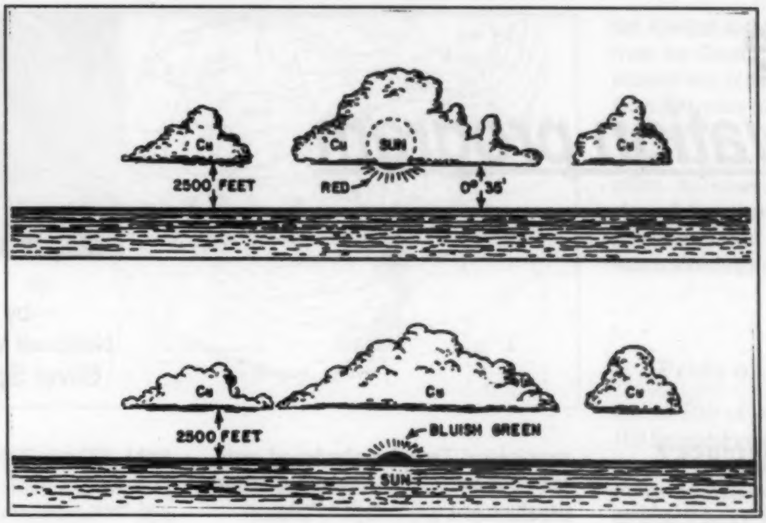
All abnormal flashes of light exhibited by astronomical bodies as they sink below or rise above the horizon cannot be accounted for by conventional refraction theory. The "normal" apparition consists of a bright bead or flash of green, more rarely blue or purple, lasting a second or so, as the upper limb of the sun (moon, Venus, or Jupiter) is covered by the horizon. The reverse order of effects occurs at sunrise.. Also considered "normal" are red flashes as the sun's lower limb appears below a sharply defined cloud bank near the western horizon. Abnormalities include: (1) Multiple flashes; (2) Long rays of colored light; (3) Structures resembling Bailey's Beads; (4) Complex fine structure of the flash; (5) Green edges around terrestrial objects viewed against the sun prior to the green flash; (6) Green flashes before the sun has set; (7) The apparent psychological origin of some green flashes; (8) The failure of the green flash to appear under ideal conditions; and (9) The apparent inadequacy of normal refraction at the horizon to account quantitatively for observations.

On December 4, 1962, in the South Pacific Ocean, near sunset at 0130 UTC, three brilliant green flashes seen as the sun's upper limb sank below three separate layers of stratocumulus. In this example, each cloud layer constituted an effective horizon. Often in such situations a red flash will appear as the sun's lower limb emerges from behind a cloud layer.

In the North Atlantic on the 21st of August, 1952, the sun's lower limb appeared to emerge at 2208 UTC from the base of a large Cumulus cloud. A brilliant red flash was observed. As the sun's upper limb sank below the horizon, a brilliant bluish-green flash was seen from its



Three successive green flashes observed in the South Pacific as the sun sank behind three cloud layers.



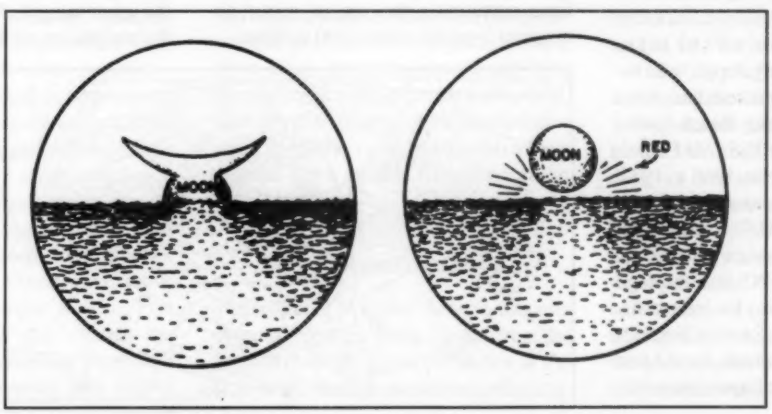
Red flash followed by green flash in the North Atlantic in August 1952.

upper limb.

Observations of red flash are rare, though it might be seen more often if it were definitely looked for in suitable conditions. In conditions of normal refraction the sun's upper limb is bordered by a narrow rim of bluish-green or green color and the lower limb by a similar rim of red color, when the sun is near the horizon. These rims are wider and therefore more likely to be observed in conditions of abnormal refraction. The upper green rim gives the well-known green flash when the sun sinks below the horizon; almost all the sun is hidden before the green coloration can be seen. The green flash has also been seen where the sun goes down behind a cloud with a sufficiently well-defined upper edge. The red flash can never be seen at the horizon since the red rim would be the last part of the sun to rise and it would be lost in the sun's general light.

On May 19, 1960 in the South Atlantic Ocean, the moon on rising at 0339 UTC was seen, when examined through binoculars, to have assumed the distorted appearance shown in the sketch. As the lowest part of the limb cleared the horizon, a brilliant red flash was observed for approximately 1.5 seconds.

With normal refraction the width of the colored rim, usually green, is 10 seconds of arc, only half of that perceptible by the normal human eye. This fact seems to dispose of the view of Rayleigh that the flash is due to the usual refraction and dispersion of the atmosphere. In other words, normal refraction and dispersion of the atmosphere. In other words, normal refraction at the horizon, the accepted explanation, seems inadequate.



Red flash from a rising moon distorted by refraction. This was observed in the South Atlantic in 1960.

marine observation program

—by Martin S. Baron
National Weather Service
Silver Spring, MD 20910

PMO Conference

The National Weather Service is holding a Port Meteorological Officer (PM0) conference, this June, in Silver Spring, MD. The conference theme will be shipboard data acquisition programs, with a focus on the methodology of the Voluntary Observing Ship (VOS) Program. We plan to discuss and evaluate all aspects of the VOS Program, including PMO ship visits, weather observing and reporting aboard ship, ship to shore communications, equipment, forms, observing aids, supplies, and the VOS program computerized data and information system. Ship masters, mates, and radio officers wishing to have their views represented at the conference should make suggestions known to the PMO's now, so these can be brought to the conference table.

New PMO In Los Angeles

Robert Webster is the new PMO in Los Angeles, replacing Tony Rippo, who retired in January. Bob was born and raised in the Los Angeles/Long Beach harbor area. He served in the U.S. Air Force's Air Weather Service from 1968 to 1972, with a tour in Vietnam as a weather observer assigned to the U.S. Army. After completing military service in 1972, he came to work for the NWS in San Diego as an upper air observer. He later transferred to the Weather Service Forecast Office in Los Angeles where, for the past 5 years, he has been the Supervisory Meteorological Technician/technical assistant. Bob and his wife Kimberly have one daughter, and reside in San Pedro.

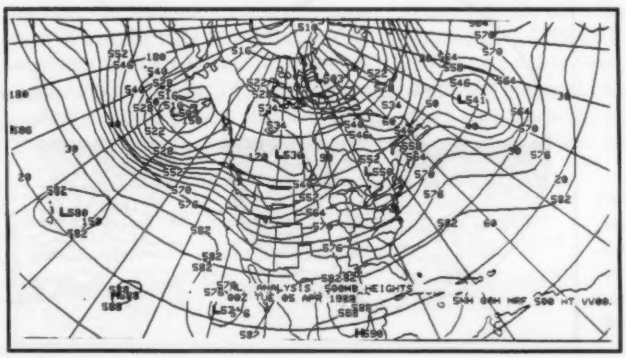
PMO Bob Webster is an L.A. native.

Using Upper Air Charts

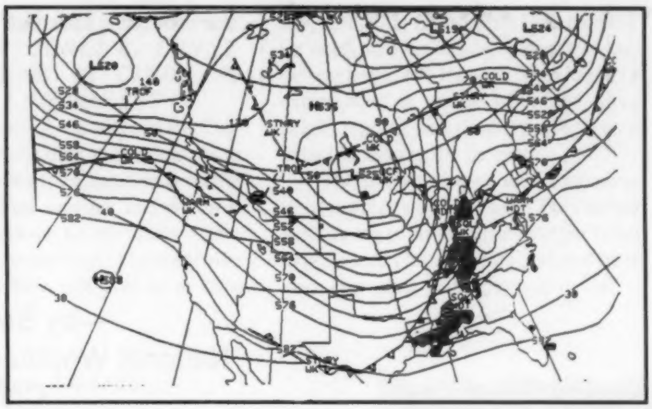
The proliferation of facsimile machines onboard ship has resulted in many questions concerning the use of upper air constant pressure charts (300 millibar (mb), 500 mb, 700 mb, 850 mb etc.) — how they're used, what they represent, and their relationship to the earths surface.

First, upper air constant pressure charts show the direction of air movement since winds are closely related to the pressure distribution. There are two kinds of air movement—translational, which is evident from the successive 12-hourly charts, and the wind motion. In the middle latitudes, there is a prevalent west to east wind component throughout the year, which strengthens during the winter months. These winds known as "the westerlies," undulate in a wavey pattern consisting of ridges or crests, and troughs provide the key to predicting the weather in the middle latitudes.

Second, troughs indicate the location of frontal systems. The trough-line itself delineates the upper air cold front, which tilts eastward to the earths' surface (the surface front is generally some distance (in the hundreds of miles or less) east of the upper trough). Thus, by noting where the troughs are on the 500-mb chart, you



A 500-mb constant pressure chart, shows westerlies, with long wave troughs located at 155°W and 40°W. Short wave troughs are at 110°W and 75°W. A ridge can be seen at 130°W. Height contours are in decameters above the earth's surface.



A 500–mb chart is shown with surface fronts. The shaded areas depict radar echoes for precipitation. Note the frontal location — to the east of the trough axis.

know where the surface fronts are likely to be. The speed and direction of movement of the trough is important - - these indicate frontal movement as well. See figure above.

Third, by delineating frontal locations, troughs and ridges indicate what weather conditions are likely to be. Low pressure systems, precipitation, and storminess, are found downstream, or east of troughs. The good weather associated with surface highs is generally found upstream or west of the troughs, especially in the vicinity of ridges (although winds you experience can be strong here).

Fourth, the thermal structure of the atmosphere is shown on upper air charts. The height lines (in decameters or tenths of meters) are lower for colder, and higher for warmer air masses. For example, when 500 mb heights lower, as with the approach of a trough, colder air is on its' way.

The amplitude and wavelength of waves in the westerlies contain important information about weather systems. Higher amplitude patterns normally contain more vigorous weather systems- - stronger highs, lows, and frontal systems (with more wind and precipitation). This is because the higher amplitude moves air masses further north or south, resulting in greater east-west thermal contrast and a buildup of energy along fronts. Wavelength provides a good indication of speed of movement - - - short waves move more rapidly than longer waves. Fast moving short waves can change the amplitude of long waves. For example a short wave trough moving into a long wave trough amplifies the cyclogenesis east of the longer wave).

Patterns of a particular amplitude and wavelength tend to persist for several weeks at a time and are the basis of long range weather prediction schemes. Changes to the westerlies tend to spread downstream, or eastward. For example, the growth of a very high amplitude 500-mb ridge is often followed by the appearance of higher amplitude troughs and ridges downstream- - - even extending around the entire hemisphere, especially in winter. A persistent high amplitude long wave ridge is often indicative of a prolonged period of good weather, while poor weather and frequent storminess are to be found to the east of major 500-mb trough lines. At the lower levels (700-mb, 850-mb), bad weather is likely to be found closer to the troughs at these levels.

The above discussion only skims the surface—professional meteorologists use many other concepts, including vorticity (rotational strength of the moving waves), and thermal advection (temperature changes for short time periods over a given area), these phenomena and form the numerical weather prediction models. This is where your weather observations come in handy- - -the models must have them to know what is happening at the earth's surface.

✍ Reminder ✍

The National Weather Service requests observations once every 3 hours from the following areas: within 200 miles of the U.S. and Canadian coastlines, including the Alaskan and Gulf of Mexico coasts; from the Great Lakes; from within 200 miles of any of the Hawaiian Islands; and from 300 miles of named tropical storms or hurricanes. From all other areas, the regular 6-hourly reporting schedule is in effect. All observations are voluntary—please follow the recommended reporting schedule as best you can, as time and watch schedules permit.

Pride of Baltimore II

On the 30th of April, with an estimated 100 thousand well–wishers in attendance, the newly christened hull of the schooner ***Pride of Baltimore II*** was lowered to its Inner Harbor berth. It has been nearly 2 years since its predecessor sank in a squall off Puerto Rico. The vessel was dedicated as a "living memorial" to the captain and three crew members lost in the disaster of May 14, 1986.

The 109–foot vessel is a copy of the swift, tall–masted Baltimore clippers of the 19th century. It will probably begin sailing in the fall after a crew has been hired. Construction of the Pride II began last spring and is expected to cost about $1.5 million by the time it is completed, later this summer.

Unlike its predecessor the Pride II, which will weigh about 190 tons, will have five watertight compartments below instead of the large open interior of a true Baltimore clipper. The new vessel is also 15 feet longer and 70 tons heavier than the old one. In addition, a 20–ton strip of lead has been bolted under the new ship's keel for added ballast. The first Pride used lead bricks and cobblestone above the keel for ballast, like the original ships.

The ***Pride of Baltimore*** sank in a feak squall, but the report by the National Transportation Safety Board indicated that the ship might not have been lost if its designer had sacrificed some historical authenticity for modern safety features. The ***Pride of Baltimore*** was part of our voluntary observation program and we hope that the ***Pride of Baltimore II*** will continue this tradition as it sails the Chesapeake Bay and the oceans of the world as a goodwill ambassador for the City of Baltimore.

PMO report

—by Bob Collins
National Weather Service
Chicago, IL.

Millions of swimmers and thousands of recreational boaters will soon crowd the beaches and waters along the hundreds of miles of southern Lake Michigan waters. At the suggestion and encouragement of Mr. Ray Waldman, Area Manager, WSFO Chicago, I was tasked with helping find new sources of data collection for the MAREP Program. I'm happy to say that some new inroads have been made

Contacts were made and meetings held with the Chicago Park District, Chicago Police Department Marine Unit and the Calumet Marine Towing Service. After explaining the problem with data collection and the need for such information to support the Near Shore Forecast, all have agreed to help us out on a regular basis. TheMAREP Program has already been enhanced as these sources have provided valuable data needed for the preparation of the Near Shore Forecast.

Sgt. James O'Boyle, of the Chicago Police Dept., Marine Unit and his staff, provide wind and wave height informaton four times a day as their patrol boats travel along the Chicago lake front. We call his office one hour prior to the issuance of the Near Shore Forecast.

Pat Barnaby and the seven tugs from the Calumet Marine Towing Service will provide data on winds and waves in the Calumet Harbor area as well as the area between Calumet Harbor and Burns Har-

bor, Indiana. The names of the boats are: the ***EDDIE B, CURLY B, LENNY B, ADRIENNE B, CINDY B, TIMMY B, AND BONESY B.***

Later this spring, we will add the Chicago Park District data to the near shore effort. They already collect data from the beaches that they operate; and we have made arrangements to call them within one hour of forecast time. There are nine locations that they will give to us each day, stretching from Leone Beach on the far north side, to Rainbow Beach on the far south side of Chicago. They are very experienced at taking wind and wave height reports, and should prove to be a valuable asset to the program.

The cooperation of these organizations is greatly appreciated. They are all well aware of the sudden changes often experienced on Lake Michigan, and have been more then willing to help us out.

The WSFO in Chicago will initiate the phone calls for the data collection which should help to keep the data flow smooth. However, if conditions require a more rapid response, each unit involved can give us a call. Hopefully, we will be able to put together a better Near Shore product, making this and future recreational seasons more enjoyable for all.

Great Lakes Awards

To further recognize the efforts of the Great Lakes vessels in taking thousands of observations each shipping season, we have begun to award Certificates of Appreciation to these vessels (right). These awards will be presented beginning at the fit out this spring. The crew of the U.S. EPA monitor vessel R/V Roger R. Simons (below) receive their award. They include Mary Ann and Alan Ingram, Gilbert Porter (1st A/E), Timothy Browning (Chief Engineer), Frederick Wright (A/B Seaman) and Captain Ronald R. Ingram. Accepting on behalf of U.S. Steel's Cason J. Callaway is Captain Roland W. Kane (below, right).


U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

Certificate of Appreciation

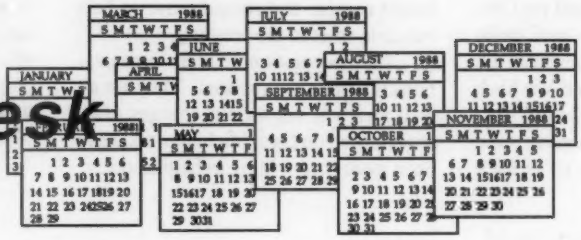
Presented to The R/V Shenahon

in recognition of your excellent support of the Great Lakes Marine Observing Program for the National Weather Service. Your contribution to the Marine Observing Program is greatly appreciated.

Robert W. Collins
Port Meteorological Officer

14 Mar 1988
Date

the editor's desk



Lighthouse Lady

We have featured several articles in the past by Elinor DeWire. We are now pleased to announce that she will be writing a lighthouse column on a regular basis. One of the finest writers we have ever had for the Log, Elinor has written over 50 articles on lighthouses for such magazines as American History Illustrated, Sea Frontiers, Americana, The Compass and Offshore. In addition she has recently had a book published, entitled: *Guide to Florida Lighthouses*, which traces the history of some 30 lighthouses that dot the coast from St. Marys River to Pensacola Bay. She has traveled extensively to research and photograph her favorite subject and also gives entertaining lectures. Elinor presently lives in Connecticut with her husband and two children. Her daughter Jessica is a budding artist as can be seen on page 20 of this issue. We are extremely fortunate to have the assistance of these two talented people.

AMVER's 30th

The Automated Mutual–Assistance Vessel Rescue (AMVER) System begins its Thirtieth Anniversary year, with an all time high growth during 1987 of more than 18 percent over the previous year.

Breaking all previous records, 503 vessels will receive first-year AMVER awards for participation, with one Soviet ship becoming the first ever to win an AMVER award. Soviet Union participation during 1987 represents 4-percent of their fleet.

AMVER began in the spring of 1958 as a Western North Atlantic reporting system and is today a full time, computerized search–and–rescue system exclusively devoted to commercial shipping. AMVER computer information is used only for humanitarian purposes.

In 1987, ships flying flags of 124 countries were AMVER participants, and a total of 2,541 awards will be presented to ship captains, shipping line managers, or to their representatives. The awards program was created in 1971 when 962 ves-

sels received awards,

Awards are made to each ship that was on the AMVER plot 128 days, or more, annually. Blue pennants are awarded to those vessels which are first–time winners. A gold pennant is special recognition for those ships receiving a fifth consecutive award. And, a purple pennant is reserved for AMVER participants receiving their tenth consecutive award. The remarkable achievement of 15 consectutive years of AMVER participation is celebrated with a plaque.

When called upon the AMVER Center offers valuable information to bonafide search-and-rescue agencies. An AMVER Surface Picture includes the position of the distressed participant as well as the location of a fellow participant who may be asked to assist. Participating vessels' information includes length and configuration, radio frequencies maintained and other capabilities.

AMVER is an economical and global search and rescue tool which avoids costly high seas diversions which result from all-ships broadcasts. With AMVER information identifying the ship closest to a distress and all other relevant data being available to a search and rescue agency, a timely and cost effective rescue is accomplished. Throughout AMVER's 30 years, participants have helped participants and fellow mariners, saving lives and property.

The ultimate goal of AMVER is to make the world's open oceans safer. And the success and growth of the System is entirely dependent upon the willingness of shipping companies, masters, and crew, and coastal radio stations around the glove to continue their support and to encourage other members of the maritime community to join the AMVER family.

Throw a fellow mariner a lifering. Participate in AMVER!

NOAA Ship Renamed

The NOAA ship ***Researcher***, an oceanographic research vessel operated by the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA), was renamed the NOAA Ship ***Malcolm Baldrige***, March 1 in honor of the late Commerce Secretary.

Mrs. Baldrige participated in the renaming ceremony, hosted by Commerce secretary C. William Verity, at the Washington Navy Yard, Pier 1. The ship was renamed ***Malcolm Baldrige*** in recognition of the late Commerce Secretary 's public service to the Nation. Secretary Baldrige died in a rodeo accident July 26, 1987.

The 2,963-TON, 278-foot ***Malcolm Baldrige***, the largest east coast ship in NOAA's fleet of 23 research and survey ships, conducts climate research in the Atlantic Ocean and Caribbean Sea. The ship is based at NOAA's National Ocean

Ports of Hawaii

The Water Resources Support Center, U.S. Army Corps of Engineers, announces the availability of Port Series Report No. 50, Ports of Hawaii.

These reports in describe the principal United States coastal, Great Lakes, and inland ports, and are compiled and published to meet the needs of Federal, State, municipal and port agencies, and others interested in the development of harbors and the use of port terminal facilities.

Port Series Reports include information on berthing accommodations, petroleum and bulk handling terminals, grain elevators, warehouses, cranes, transit sheds, marine repair plants, fleeting areas, and floating equipment.

The locations of the described facilities are depicted on serial photographic maps of the waterfront areas.

Port Series Report No. 50 may be purchased for $7.00. Please address orders to Port Series Reports, (CEWRC-NDC-P), Casey Building, Fort Belvoir, Virginia 22060-5586; include money order or check (U.S. funds) made payable to Superintendent of Documents. We are required by law to receive payment in advance for all purchases. Telephone orders are accepted from holders of Superintendent of Documents accounts or interbank credit cards (Visa, Master Card or Choice only) Publications normally are mailed postpaid on the same day order is received. The telephone no. is (202) 355-2495.

Coast Guard Radio Safety Bulletin Service

Several years ago the Coast Guard began NAVTEX, an internationally–adopted, automated system, which instantly distributes marine navigational warnings, weather forecasts and warnings, radionavigational information, ice warnings, local mariner notices and rescue messages to all types of ships.

The service, which began in Boston, MA in 1983, is now operating along the east and Gulf Coasts from Maine to Texas. It will be extended to all coastal areas including Puerto Rico, Hawaii, Guam, Alaska and the West Coast by 1989.

The heart of this system is a small, self-contained "smart" receiver and printer installed in a vessel's pilot house, which has the capability of checking each incoming message to determine if it has

PORTS OF HAWAII

been received before, or if it will be of interest to the ship's master. If it is a new or desired information, it is printed on a roll of adding-machine-size paper for the ship's master to read at his convenience. If it is not new or desired, the message is ignored.

A ship coming into a new area will receive many messages that have already been broadcast. Ships already in the area that have received the same message will not receive them again.

Previously, a crewman had to be listening to a ship's radio to hear the voice or Morse-coded broadcast in order to receive information that could affect the safety of his ship. Under those conditions, the Coast Guard could not always alert mariners in a particular area of life-threatening storms or other hazards. With NAVTEX, a printed message can be received even though the radio receiver is not manned.

NAVTEX provides navigational safety information to all types of mariners, from recreational boaters, yachtsmen, and fishermen, to merchant seamen, with less of a burden on the part of the ship's crew. The International Maritime Organization, a United Nations agency, is planning to require NAVTEX receivers on all merchant and passenger vessels over 200 tons by 1991.

Cost of the receivers, which are marketed by a number of marine electronics companies in the United States, ranges anywhere from $2,000 to less than $1,000.

Postgraduate Summer School

The University of Dundee is offering a course on Microwave Remote Sensing for Oceanographic and Marine Weather Forecast Models, from the 14th of August through the 3d of September, 1988.

The power of microwave remote sensing for studying the oceans of the world was demonstrated conclusively the the SEASAT MISSION in 1978. Since then no other satellite-flown instrument has been made available to provide further data of this type. However, the proposed launch of the European Space Agency's satellite ERS-1 will lead to a new set of active microwave instruments being flown in space in 1988-89. It is essential that user will be fully prepared to make use of the data when it comes on stream and this summer school will be aimed particularly at showing how to exploit this data. Topics covered are expected to include:

- Principles of Microwave Scattering by the Sea Surface
- Satellite Systems
- Scatterometers, altimeters and microwave radiometers.
- Sounding instruments and thermal infrared line scanners
- The SEASAT data experience
- Wind fields and surface fluxes
- Waves
- Ice Edge
- Integration of data from different sources
- Modelling, assimilation of data, results
- Major large-scale experiments
- Access to satellite data

For further information and application forms please contact:

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Telex 76293 ULDUND G

Changes in Wind?

The U.S. Department of Commerce is considering two changes that relate to the National Cooperative Observing Program: A-76 Contracting and Privatization. The A-76 contracting option, which is scheduled for implementation by the end of 1988, would contract the receipt, quality control, processing, and publication preparation functions of the National Climatic Data Center to the lowest-bidding private company that submits an acceptable proposal. Government employees would continue the functions if commercial bids are not lower than the cost of continued government operation.

The privatization option, which is in the early planning stages and has no current implementation schedule, would allow private companies to assume all or part of the functions of the National Climatic Data Center. Rather than contracting (where the government pays a private company for goods and services), privatization would turn portions of the Center over to a company to operate for-profit. Both of these programs are part of the government's policy to economize and privatize government services.

Safety Board News

According to the National Transportation Safety Board, the U.S. Coast Guard, through the State Department, should develop an agreement with the Government of Mexico to allow U.S. search and rescue units to fly over and land on Mexican soil when on a mission.

The Board's recommendation was contained in its final report of the sinking of the charter fishing vessel Fish–N–Fool off the coast of Baja California, Mexico. Of the 12 persons on board 10 died when the San Diego–based vessel capsized in heavy swells on February 5, 1987. The survivors were rescued about 7 hours after the accident.

The Safety Board said that the probable cause of the accident was the failure of the captain to maintain the vessel at a safe distance from an area of large, breaking swells in shallow water at Ben's Rock. Contributing to the loss of life was the inadequate passenger safety briefing and inadequate training of the deckhand, and the subsequent decision to swim the 2 1/2 miles to San Martin, rather than return to the capsized vessel, which didn't sink for several hours. A Coast Guard helicopter was delayed so that it could take on enough fuel to get to the scene and return. Had Mexico observed a policy of automatic entry for search and rescue units, like several Central American countries, the helicopter might have been able to depart sooner and refuel, if necessary in Mexico. Another recommendation included esatblishing specific Coast Guard procedures in responding to EPIRB signals and SARSAT reports.

tips to the radio officer

—by Jullie L. Houston
National Weather Service
Silver Spring, Md.

Important Reminder! A Recurring Problem!

Some Ships transmitting OBS via USA CES INMARSAT are neglecting to disconnect the transmitter after sending their observations. This is causing a substantial cost to the National Weather Service (NWS). The NWS limit for an observation is not to exceed two minutes. For example, a ship failed to disconnect its sending equipment after completing the message leaving the transmitter open to 89.0 minutes costing a total of $404.95.

The NWS also reminds ships to use the correct format for Meteorological Surface OBS and Bathythermal OBS. For example:

(1) Bathys should start with **JJXX** and end with the **Call Sign**

(2) Met Surface OBS should begin with the **Ship's call sign** and end with **FIVE PERIODS.**

Interlacing Bathy and Ship Surfaces OBS format in one transmission results in loss of data within the system.

INMARSAT Weather Reports

INMARSAT equipped ships may transmit weather messanges using the following procedures after the message is composed off-line:

1. Select U.S. Coast Earth Station Identification Code 01.
2.Select routine priority.
3. Select duplex telex channel.
4. Initiate the call. Upon receipt of GA+ (Go Ahead).
5. Select dial code for meteorological reports, 41, followed by the end of selection signal, +.
6. Upon receipt of our answerback, NWS OBS MHTS, transmit the ships call sign and the weather message only. Do not send any other preamble.

Example:
GA+
41+
NWS OBS MHTS
WLXX 29003 99131 70808 41998 60909
10250 2021/ 40110 52003 71611 85264 22234 00261 20201 31100 40803 .....

The five periods indicate the end of the message.

7. Terminate the call with manual disconnect.

Update

The publication "Selected Worldwide Marine Weather Broadcast" is being reformatted and updated, please send any schedule changes to the following address:

National Weather Service
International Telecommunications
Section W/OS0151 Room 419
8060 13th Street
Silver Spring, MD 20910

the mail bag

Captain Jerome Benyo, in command of the MV *Delaware Bay* was kind enough to take the time to drop us a line. The following is an excerpt from his letter:

When I returned to take over Command of my vessel in the North Atalntic trade a few days ago I found aboard your issue Vo. 32 No. 1, Winter of 1988 and was especially interested in your article Anatomy of a Monster.....

I live in Kent England midway between London and Dover and as luck would have it I was at home and not at sea when this storm occurred. Fortunately I had no damage to my house but it was probably the highest winds I have experienced while not at sea.

I have a number of clips from the London papers on this storm and am enclosing them for your review.

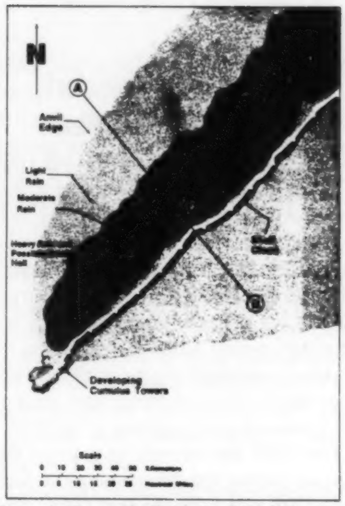
I thank Captain Benyo for his letter and the clippings, which were used to help update the storm summary that appears in the Marine Weather Review. The British Met Service, one of the best in the world, took a lot of heat about this storm and I am not in a position to comment on the forecasts. However I would like to say that it was a very rapidly developing small scale feature, similar to some of the systems that create problems off Cape Hatteras in the U.S. The primary concern of all marine meteorologists is safety of the ships at sea above all else. —Ed

H. Michael Mogil, meteorologist at the National Weather Service, sent in the following comments:

Compliments to Bob Collins concerning his fine article about sailing on the Coast Guard Cutter — ***Mackinaw***. However there was an error in his article and in the cover photographs, which you may wish to correct. The cloud feature Collins saw and photographed was not a roll cloud. Rather it was a shelf cloud, which also indicates the leading edge of strong outflow thunderstorm winds. Closer examination of the photographs would suggest the clouds are layered or stacked like shelves atop one another.

The National Weather Service has produced a *Spotter's Guide for Identifying and Reporting Severe Local Storms*. This 16–page guide includes a wealth of information about cloud signatures that foretell severe weather. Examples of both the shelf and roll clouds are included. The guide (GPO No. 003–018–00006–8) can be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402–9532. It cost $2.75. Checks should be made payable to the Superintendent of Documents.

There is also an NWS prepared movie/videotape on severe weather spotting. It can be purchased or borrowed (small fee) from the National Audiovisual Center, 8700 Edgeworth Dr., Capitol Heights, MD 20743–3701. Contact Pam Gorman (301–763–1850).



From the Spotter's Guide for Identifying and Reporting Severe Local Storms is this view of a squall line as seen from above. Precipitation is shown in the central area and the gust front is the white line with teeth. The strongest winds usually occur a few minutes after the gust front passage, just before or just after rain and hail begin. If tornadoes occur, they are usually weak, short–lived and found along the gust front. Occasionally a tornadic thunderstorm will develop in association with a squall line. These storms are most often on the south end or ahead of the squall line. The most distinctive cloud associated with the squall line is the Shelf Cloud. It is usually located above the squall line gust front. An individual tornadic thunderstorm or even an isolated non–severe thunderstorm may at times develop a shelf cloud associated with its gust front.

hurricane alley

North Indian Ocean Tropical cyclones, 1987

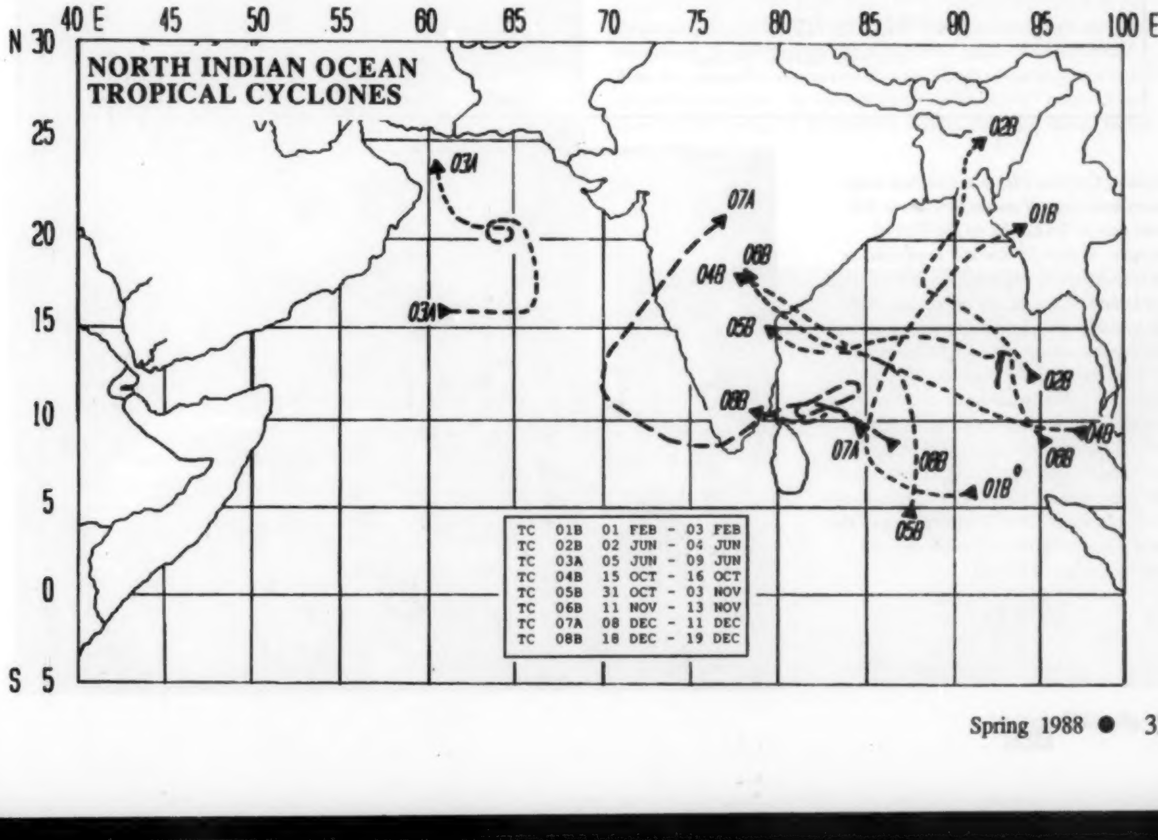
Based on material provided by the Joint Typhoon Warning Center, Guam

Eight significant tropical cyclones developed in the North Indian Ocean during 1987. That set a new all–time record, surpassing the previous high of seven systems in 1979. This was in sharp contrast with 1986, when only three significant tropical cyclones were observed. The mean is four per year. These eight tropical storms developed during the spring and fall transition seasons, which fall between the Northeast and Southwest Monsoons.

NORTH INDIAN OCEAN
1987 SIGNIFICANT TROPICAL CYCLONES

TROPICAL CYCLONE	PERIOD OF WARNING	CALENDAR DAYS OF WARNING	NUMBER OF WARNINGS ISSUED	MAXIMUM SURFACE WINDS-KT (M/S)	ESTIMATED MSLP - MB
TC 01B	01 FEB - 03 FEB	3	11	55 (28)	984
TC 02B	02 JUN - 05 JUN	4	12	55 (28)	983
TC 03A	05 JUN - 09 JUN	5	18	50 (26)	987
TC 04B	15 OCT - 16 OCT	2	3	45 (23)	991
TC 05B	31 OCT - 03 NOV	4	14	40 (21)	994
TC 06B	11 NOV - 13 NOV	3	6	50 (26)	987
TC 07A	08 DEC - 11 DEC	4	14	45 (23)	991
TC 08B	18 DEC - 19 DEC	2	5	35 (18)	997
	1987 TOTALS:	26*	83		

*Overlapping days are counted only once in sum.



FREQUENCY OF NORTH INDIAN OCEAN TROPICAL CYCLONES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1971*	-	-	-	-	-	0	0	0	0	1	1	0	2
1972*	0	0	0	1	0	0	0	0	2	0	1	0	4
1973*	0	0	0	0	0	0	0	0	0	1	2	1	4
1974*	0	0	0	0	0	0	0	0	0	0	1	0	1
1975	1	0	0	0	2	0	0	0	0	1	2	0	6
1976	0	0	0	1	0	1	0	0	1	1	0	1	5
1977	0	0	0	0	1	1	0	0	0	1	2	0	5
1978	0	0	0	0	1	0	0	0	0	1	2	0	4
1979	0	0	0	0	1	1	0	0	2	1	2	0	7
1980	0	0	0	0	0	0	0	0	0	0	1	1	2
1981	0	0	0	0	0	0	0	0	0	1	1	1	3
1982	0	0	0	0	1	1	0	0	0	2	1	0	5
1983	0	0	0	0	0	0	0	1	0	1	1	0	3
1984	0	0	0	0	1	0	0	0	0	1	2	0	4
1985	0	0	0	0	2	0	0	0	0	2	1	1	6
1986	1	0	0	0	0	0	0	0	0	0	2	0	3
1987	0	1	0	0	0	2	0	0	0	1	2	2	8
(1975-1987) AVERAGE	0.2	0.1	0.0	0.1	0.7	0.5	0.0	0.1	0.2	1.0	1.5	0.5	4.7
CASES	2	1	0	1	9	6	0	1	3	13	19	6	61

* JTWC WARNING RESPONSIBILITY BEGAN ON 4 JUN 71 FOR THE BAY OF BENGAL, EAST OF 90 DEGREES EAST LONGITUDE. AS DIRECTED BY CINCPAC, JTWC ISSUED WARNINGS ONLY FOR THOSE TROPICAL CYCLONES THAT DEVELOPED OR TRACKED THROUGH THAT PORTION OF THE BAY OF BENGAL. COMMENCING WITH THE 1975 TROPICAL CYCLONE SEASON, JTWC'S AREA OF RESPONSIBILITY WAS EXTENDED WESTWARD TO INCLUDE THE WESTERN PORTION OF THE BAY OF BENGAL AND THE ENTIRE ARABIAN SEA.

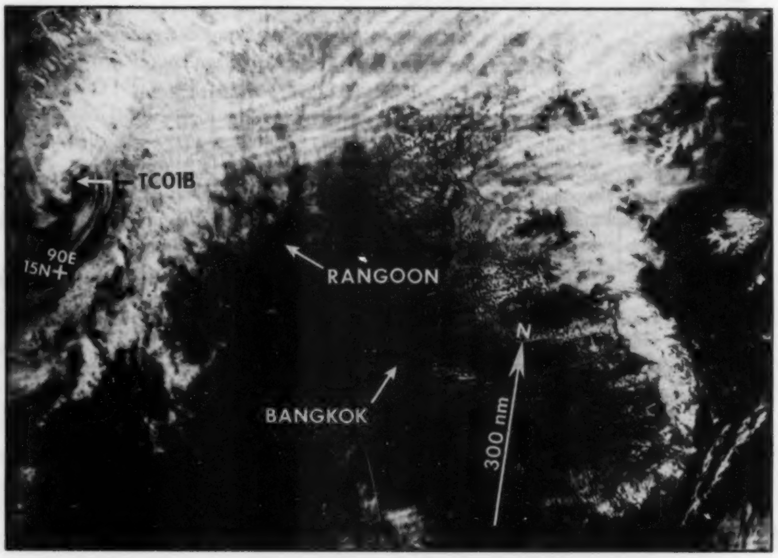
FORMATION ALERTS: 7 OF 8 FORMATION ALERTS DEVELOPED INTO SIGNIFICANT TROPICAL CYCLONES. TROPICAL CYCLONE FORMATION ALERTS WERE ISSUED FOR ALL OF THE SIGNIFICANT TROPICAL CYCLONES THAT DEVELOPED IN 1987, EXCEPT TROPICAL CYCLONE 03A.

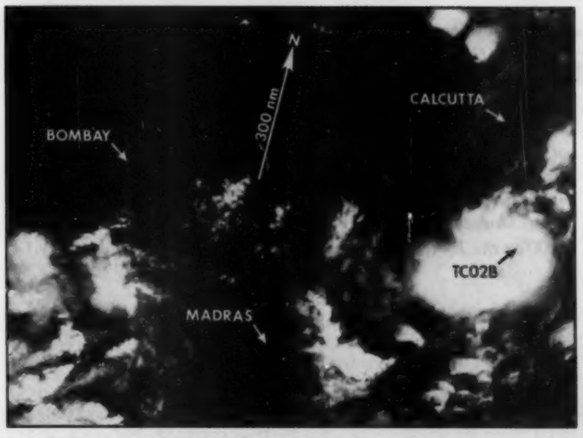
WARNINGS: NUMBER OF CALENDAR WARNING DAYS: 26

NUMBER OF CALENDAR WARNING DAYS WITH TWO TROPICAL CYCLONES: 1

NUMBER OF CALENDAR WARNING DAYS WITH THREE TROPICAL CYCLONES: 0

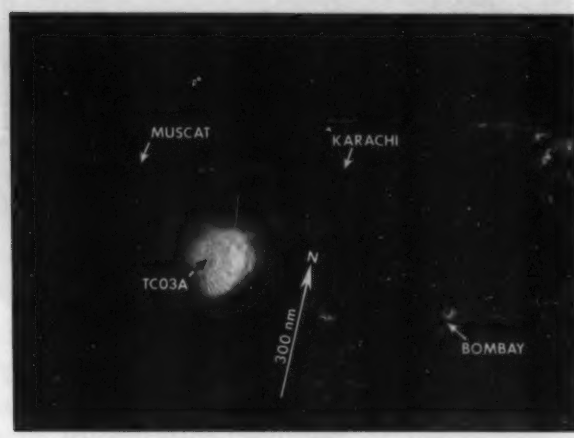
Tropical Cyclone 01B was detected as an amorphous area of convection about 500 miles east of Sri Lanka on the 29th of January. Within 24 hours it organized as the convection increased. The first warning was issued on the 1st of February at 0000. The system tracked steadily northeastward. The maximum intensity was 55 knots at 0600 on the 2d as the storm began to interact with upper –level southwesterlies. A partially exposed low-level circulation center became apparent at 0000 on the 3d and 6 hlours later the low-level vortex was fully exposed (see right). JTWC issued their final warning at 1200. The remnants of the storm made landfall on the 4th over the northwest coast of Burma.

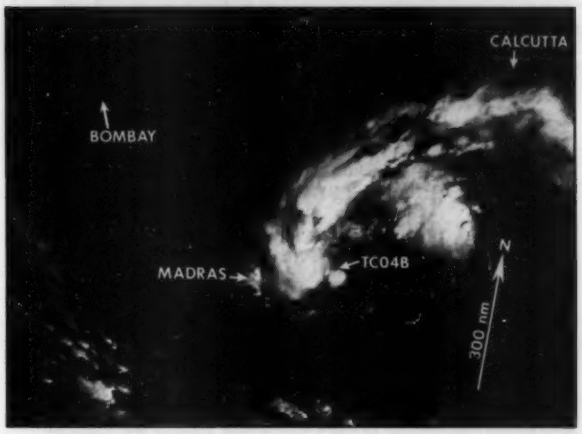




Tropical Cyclone 02B (left) was first detected as an area of organizing convection about 220 miles southwest of Rangoon, Burma on the 30th of May. As a result of continued development the first warning was issued at 0600 on the 2d of June. At 0600 on the 4th the tropical storm reached a peak with winds of 55 knots and a ragged eye. This intensity was maintained until the system made landfall over Bangladesh at 1200 on the 4th. Nc reports of damage or loss of life were received. (June 3, 0421Z, DMSP visual imagery.)

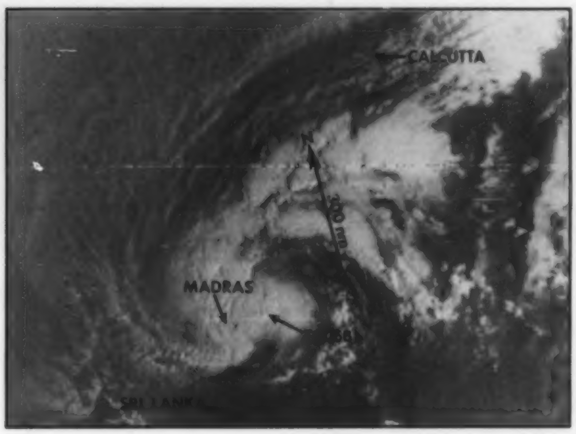
Tropical Cyclone 03A (right) began on June 4th as a monsoon depression with supporting convection displaced from the low–level circulation center. The low pressure center developed 250 miles southeast of central Oman and moved slowly eastward along the edge of the low–level southwesterlies. JTWC issued its first warning at 0600 on the 5th, but post analysis indicated the system had reached tropical storm intensity some 18 hours before. Tropical Cyclone 03A reached a maximum intensity of 50 knots at 0000 on the 6th shortly before it turned abruptly northward. This intensity was maintained until the 8th, when the course turned to westerly. The final warning was issued on the 9th at 1200. (June 11th, 0501Z, DMSP visual imagery.)

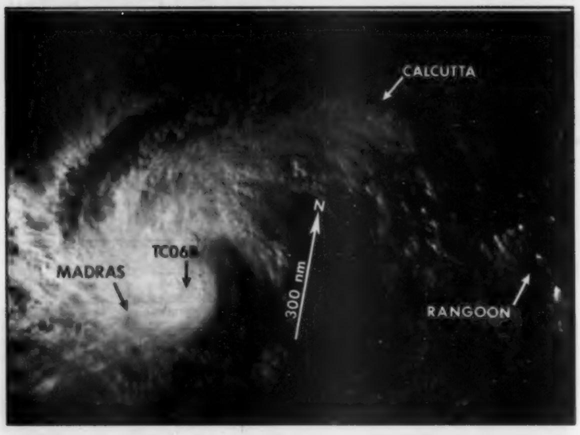




Tropical Cyclone 04B (left) began as a monsoon depression in the Andaman Sea on the 12 th of October and tracked toward the west northwest. By early on the `13th the cloud system had separated from the general monsoon cloudiness. The first warning was issued at 0000 on the 15th. By 1800 the storm peaked at 45 knots. However by 0000 on the 16 th the storm was finalled as it moved inland and weakened.

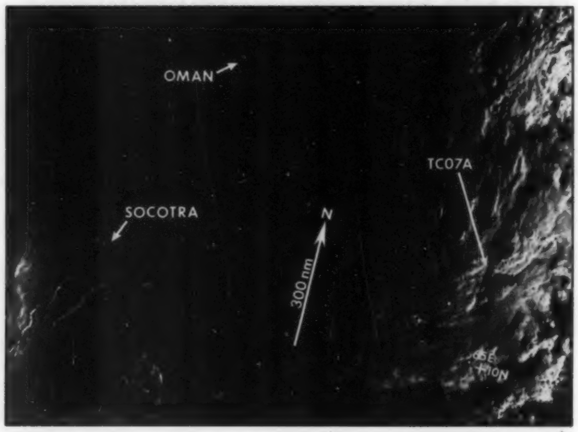
Tropical Cyclone 05B (right) was spawned by a monsoon trough over the southern Bay of Bengal, midway between Sri Lanka and northern Sumatra in late October. The first warning was issued at 0000 on the 31st. The storm moved toward the north and then northwest and slowed down. The peak intensity of 55 knots was reached at 1200 on the 1st of November and maintained until the system was close inshore. The final warning was issued at 0600 on the 3d as the system was dissipating over land. (November 2d, 0221Z, NOAA visual imagery.)

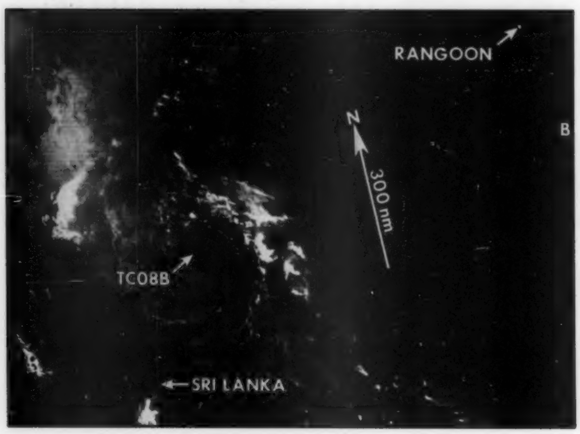




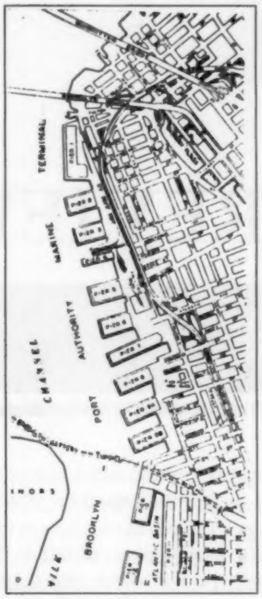
Tropical cyclone 06B (left) first showed up on satellite imagery on the 8th of November as a weakly organized area of convection in the northern Andaman Sea. Initially it was associated with a broad band of monsoonal cloudiness, which extended from southern India eastward to the central Andaman Sea. The first warning was issued at 1800 on the 11th. The storm reached a peak intensity of 50 knots some 24 hours later, as it turned northwestward. Four hours later it made landfall and rapidly weakened while moving into the Eastern Ghats Mountains along the coast. The final warning was issued at 0000 on the 13th. (November 12th, 0929Z, NOAA visual imagery.)

Tropical Cyclone 07A (right) was the first significant December tropical cyclone in the Arabian Sea since 1980. It also marked the first time since 1979 that seven significant tropical cyclones have occurred in the North Indian Ocean. The system initially developed on the 2d of December and slowly intensified before making landfall on the southeast coast of India on the 4th some 150 miles south of Madras. The depression moved across the southern tip of India and reintensified in the Arabian Sea. The first warning was issued at 1200 on the 8th. A maximum intensity of 45 knots was reached at 1200 on the 10th, prior to the storm recurving northward. It then headed for the west coast of India, but weakened before making landfall on the 12 th at 0000 some 90 miles south of Bombay.





Tropical Cyclone 08B (left) was the record-setting eighth storm to develop in the North Indian Ocean in 1987. It began as a rapidly organizing tropical disturbance 375 miles east of Sri Lanka on the 16th. The first warning was issued at 1400 on the 17th. The 30-knot depression was forecast to move inland near Madras and dissipate within 48 hours, however it slowed and changed course, heading for the northeast. A final warning was issued at 0000 on the 19th, but the exposed low-level circulation center maintained its identity and re-developed its central convection. The remnants, with satellite estimates of 35-knot winds, tracked northeastward. On the 21st the tropical cyclone began to weaken and loop back toward the Indian subcontinent. It made landfall on the 23d, some 165 miles south of Madras, but no reports of major damage or loss of life were received.



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MARINE WEATHER REVIEW

October, 1987— The average sea level pressure chart was nothing like normal (fig 1). The 1026-mb High is reminiscent of July while the Icelandic Low at 998 mb represents a misplaced Aleutian Low in January. This just about tells the story for the month. The northeast Atlantic, Norwegian and North Sea was a nightmare while the mid Atlantic was, for most of the time, a dream. This was reflected in a +9mb departure southeast of Newfoundland and a -9mb departure off southwest England. The steering currents at 700 mb were tight north of 45° N and oriented in such a way that a Low off Long Island might end up over Spain after moving northeastward, southeastward and northeastward again.

On this date—October 8, 1871—Prolonged drought and desiccating winds led to the Great Chicago Fire, the Peshtigo Horror and the Michigan Fire Holocaust all on this day. Fire destroyed more than 17 thousand buildings, killing more than 200 people in the city of Chicago, Ill. while it consumed the town of Peshtigo WI, killing more than 1100 people. In Michigan 2.5 million acres were burned resulting in some 200 deaths.

Extratropical Cyclones—The large summer like Azores — Bermuda High forced many storms to the north so that northern shipping lanes, particularly the northeast, bristled with activity. Western Europe and the seas that bathe it had a rough go. From the 3d through the 6th, in Spain, 13 people lost their lives in severe weather; seven were foreign tourists. The following weekend in southern England heavy rain created floods up to 12 ft in parts of Essex. On the Isle of Wight a combination of torrential rains and unusually high tides caused extensive flooding. In southern France two people died as heavy storms and 65-kn winds lashed the wine growing regions. Once again Spain suffered when at least three people died in severe weather in the northeast. The strong winds and torrential rains swept through Italy. Venice was under more water than normal and Naples was the victim of a severe thunderstorm on the 9th, which brought winds up to 38 kn and heavy rains.

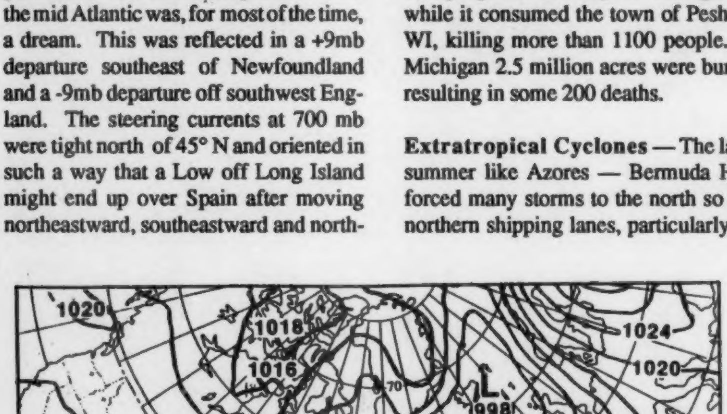


Figure 1.—An abnormal picture of fall.

➊ This Great Lakes storm was developing over northern Manitoba as the month opened. It swooped southeastward and brought gales to the lakes as pressure fell to 990 mb at 1200 on the 2d (fig 2). At 0600 the VA 22 hit 50-kn southwesterlies in 12-ft seas on Lake Erie; nearby the ***Enerchem Catalyst*** reported a 43-kn blow. At 1200 at least seven vessels radioed gale or storm force winds. Highest reports were the WXQ4 with 60-kn north northwesterlies and the WY P8 with 55-kn northerlies, both in Lake Superior. In general winds ranged from 40 to 50 kn. Seas were running 8 to 10 ft. East of Sault Ste. Marie, at 1200 on the 2d, the storm swung toward the northeast and began to

The Weather Logs combined with the cyclone tracks, U.S. Ocean Buoy Climatological Data, gale and wave tables and mean pressure patterns provide a definitive report on the primary storms that affect the North Atalntic and North Pacific Oceans. The Monster of the Month is a title given to an extratropical storm that may have been particularly hazardous to shipping. All storms are dangerous! Unless otherwise stated, winds are sustained and time is UTC. The number next to the summary corresponds to the appropriate number on the track charts.

North Atlantic Weather Log

October, November and December

weaken rapidly. By the 3d only a scattering of gale reports were received.

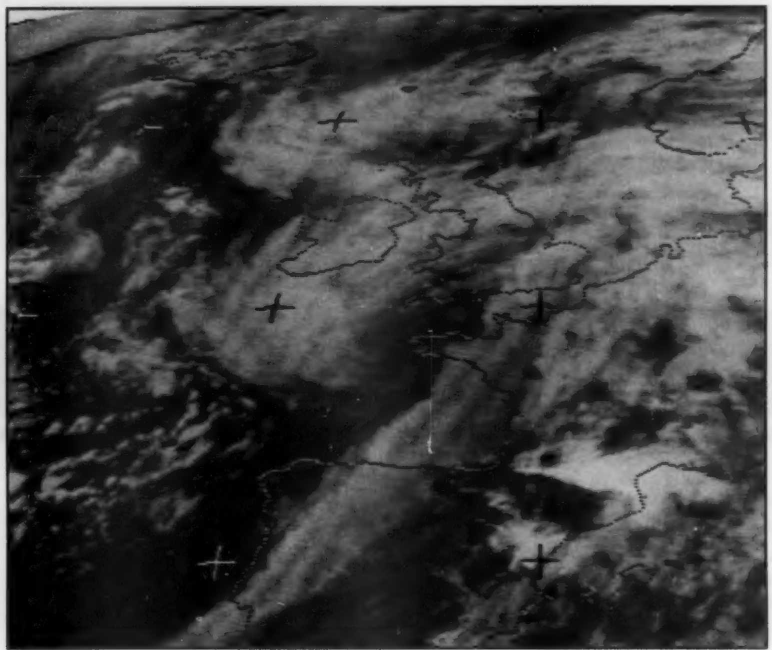
❷ While the previous storm was developing, this system came to life over New Brunswick on the lst. Moving northeastward across the Gulf of St. Lawrence and into the Labrador Sea, central pressure fell from 997 mb to 978 mb in a 24-hr period. Gales were being reported to the south and southeast of the center, and seas were running 12 to 16 ft. At 1800 on the 2d the VOCG (51°N, 56°W) encountered 52-kn westerlies and other valuable reports came in from the ***Marita Leonhardt, Actuaria, Sovietsk, Eastern Shell*** and the ***Hudson***. By the 3d the 976-mb Low was heading through the Denmark St. The following day it turned a counterclockwise loop and headed eastward, just south of Iceland. At 1200 on the 3d the ***Bjarni Saemundsson*** and the ***Arni Fridriksson***, both reported 52-kn south southeasterlies near 65°N, 24°W. The ***Magnus Jensen*** in 48-kn westerlies encountered 16-ft seas with a slope of about 1/25. At 1200 on the 3th the ***Jokulfell*** (62°N, 29°W) was belted by 44-kn southwesterlies and reported a 986.5-mb pressure. On the 6th the system began to fill as it swung northward. At 1200 on the 5th the ***Sigurour Palmason*** (67°N, 20°W) ran into 52-kn northeasterlies; she also reported a 980-mb pressure. Once north of 70°N, on the 7th, central pressure dipped to 960 mb and gales were being generated over the Norwegian and North Seas. The XX92 at 1200 on the 7th, near 53°N, 4°E, was hit by 62-kn southerlies. The system meandered through the Norwegian Sea for several more days and was joined by another storm that had moved across England on the 7th.

Satellite Applications Branch

Figure 2.—The Great Lakes storm at 1330 on the 2d.

❸ Monster of the Month - It was a complex system that spawned this short-lived but devastating monster, which was described in the winter 1988 edition (pg. 17). To vessels, platforms and rigs in the North Sea this stretch of weather was anything but short-lived.

At 0000 on the 15th a center was picked up over the English Channel, another 600 mi to the west and a third just south of Iceland. Off the northwest coast of Spain was a wave along an associated frontal system. The ***Edouard L.D.*** (40.7°N, 10.0° W) was reporting 40-kn southerlies —nothing unusual in this setting. On the evening of the 15th the wave, now over the Bay of Biscay, began to deepen explosively. By midnight (GMT) the center was close to southwest England (fig. 3). During the early hours of Friday the 16th, an intense storm tracked northeastward across central England causing severe damage as winds climbed to hurricane strength. By dawn the center had reached the east coast near the Humber Estuary. The lowest pressure recorded in the center of the Low was about 956 mb over Cornwall just after midnight. It was still at 960 mb as it reached the east coast moving at a forward speed of 40 kn. Strongest winds around the Low were mainly to the south and east. The highest



Satellite Applications Branch

Figure 3.—This IR photo was snapped at 2230 on the 15th, as the storm was deepening rapidly.

gusts in the East Anglia region were 87 kn at Shoeburyness and 78 kn at Hemsby. In some areas pressure fell in excess of 25 mb in 3 hr. While those ashore had a rough night many aboard ships, particularly in the North Sea had a rough week.

The story as told by ship reports is an interesting one. Let's go back to the beginning. At 0600 on the 15th there were mainly two areas besieged by gale and storm force winds. Off northwest Spain several vessels were coming in with 40-to 50-kn winds in 12-to 20-ft seas. In the North Sea, off Germany and the Netherlands, winds were in the range of 45 to 55 kn, with seas of 12 to 16 ft. Pressures in the North Sea were running 978 to 980 mb compared to 985 to 990 mb off Spain. By 1200 on the 15th gale reports stretched from northwest of Morocco into the northern North Sea, with a plethora near the southern Bay of Biscay. A report by the ***Tabasco***, near 41.4°N, 15.7°W, might have been a harbinger of things to come. They encountered 65-kn westerlies with a 980.5-mb pressure in 26-ft seas and 33-ft swells— was anyone listening? By 1800 winds of 55 to 60 kn were common in the Bay of Biscay where vessels, buffeted by 18-to 36-ft seas, were reporting pressures near 965 mb. These valuable ship reports indicated something out of the ordinary was happening and fast. The ***Jack Wharton*** reported an 8-mb pressure fall in 3 hr, where 2 mb per hour is considered a rapid fall. The indicators were there.

By early on the 16th the North Sea was under siege. Sustained winds were running 45 to 65 kn in seas of 10 to 26 ft. And these were from vessels that had time to radio. Pressures ranged from 998 mb to 955 mb — a very tight gradient. Reports poured in from ships, rigs and platforms too numerous to mention by name. Steep slopes were reported with seas of 20 to 30 ft, probably breaking in many areas. A series of trailing Lows to the west of the British Isles kept things hopping in the North Sea until the 23d. This was more than a week of battling gales and rough seas.

❶ On the 20th, just south of western Lake Erie, an atmospheric wave formed along a northeast-southwest oriented stationary front. Moving northeastward it took on a definite circulation by the 22d as it headed across Newfoundland. From 1200 on the 2d to 1200 on the 23d central pressure dropped from 1004 mb to 968 mb. The VSBC, ***Concert Express, Polyarny Krug*** and the ***Wilfred Templeman*** reported in with 40-to 45-kn winds in 12-to 20-ft seas. They were all 300 to 600 mi south of the storm center, which was moving rapidly northeastward. On the 24th it slowed and turned toward the southeast, as it approached the Denmark St. After dropping to 964 mb by 1200 on the 24th, the Low began to fill. That night of the 23d was a wild one over the northern shipping lanes. At 1800 the ***Polyarnoye Siyaniye*** ran into 58-kn westerlies, while 12-hr later OSV C near 53°N, 36°W, encountered 41-kn west winds in 21-ft seas. Gales continued into the 26th. The ***Lackenby*** at 1200 on the 15th, in 50-kn winds battled 23-ft seas with a slope about 1/6, which indicates very steep, maybe breaking seas. This battle continued through the 26th.

Tropical Cyclones — October averages nearly one hurricane every year and this year it was Floyd. A complete summary of Floyd can be found in the winter 1988 issue (pg. 15). Briefly, Floyd became a tropical depression on the 9th and reached tropical storm strength the following day off Honduras. Moving northward, Floyd crossed western Cuba on the 12th and attained hurricane status shortly thereafter. The storm moved through the Florida Keys generating 70-kn winds around a 993-mb pressure center. Floyd quickly lost its strength northeast of the northern Bahamas. Floyd, however did cause some problems to shipping in both tropical and extratropical stages.

Casualties — The Monster of the Month casualties are included in the Winter 1988 edition (pg. 17). On the 8th the ***Indian Harbor*** while backing into the harbor at Lorain, OH got caught in high northwest winds and currents and blew against the outer breakwall. During Floyd the tug ***Johnny Peterson*** broached her barge on the 11th, near 18°N, 82°W, and was unable to cut connecting cables. The ***Atlantic Rainbow*** rescued all five persons aboard, from the ship's life raft. On the 12th, also in Floyd,

Wide World

Figure 4.—The Coast Guard Cutter ***Cape Shoalwater*** *stands by the abandoned 400-ft Venezuelan container ship,* ***Alma Llanera****, as it lists severely in high seas 30 mi east of Ft Lauderdale, FL, after a dramatic rescue of the 26 people aboard.*

the ***Hybur Trader*** lost 17 containers overboard off Miami Beach. The containers, it was reported, were stripped by locals. The ***Alma Llanera*** reported early on the 13th, cargo shifted with vessel listing (fig 4). At 0430 her crew abandoned the vessel 10mi east of Hillsboro Inlet, Ft. Lauderdale, FL. A Coast Guard vessel rescued the crew of 25.

On the 23d the ***Velos 1*** was reportedly in contact with pier at Poros, Greece due to strong winds. On the same day the ***Federal Seaway***, from Toledo to Bremerhaven, sustained heavy weather damage. The following day the ***Chamois***, from Lisbon to Baltimore sustained heavy weather damage.

In the Black Sea on the 29th the ***Topkapi S.*** went down in heavy seas about 40 mi from the port of Eregli. According to survivors, she sank within minutes. There are 11 seafarers missing after an extensive search and rescue mission. Five bodies were recovered and two crewmen were rescued after managing to lauch one of the ship's lifeboats. A spokesman for Sonmez Shipping of Istanbul said that the ***Topkapi S*** ran into force 11 winds (56-63kn).

November, 1987 — On the climate chart (fig 5) the Icelandic Low was deeper than normal particularly off southeast Greenland and in the Baffin Bay—Davis St waters, where anomalies of -5 to -7 mb were common. On the other hand the Azores—Bermuda High looked closer to the pattern of August than November, resulting in positive anomalies of 4 mb near Bermuda and 7 mb just southwest of England. All of this indicates the concentration of storm tracks on either side of Greenland and the lack of activity off England, Spain and France and in the western central Atlantic. The 700-mb pattern showed steering currents curving cyclonically from west to east out to about 20°W and then anticyclonically to Europe. This means, ideally, a system off New York would end up in the Bay of Biscay.

On This Date — Nov 11, 1968 — The Veteran's Day Storm of '68 occurred producing high winds and record early snows from Georgia to Maine. Winds reached nearly 80 kn in Massachusetts. The Diamond Shoal lightship battled 30-ft seas, while the ***Napeague*** near Ocracake Inlet ran into trouble in 60-kn winds and 35-ft seas. In New York the Bronx - Whitestone Bridge was swaying so much that panicky drivers jumped from their cars and fled the bridge.

Extratropical Cyclones — The track chart looks rather uncluttered for the month, but several severe storms made it rough over the shipping lanes as did the tight gradients created by a number of

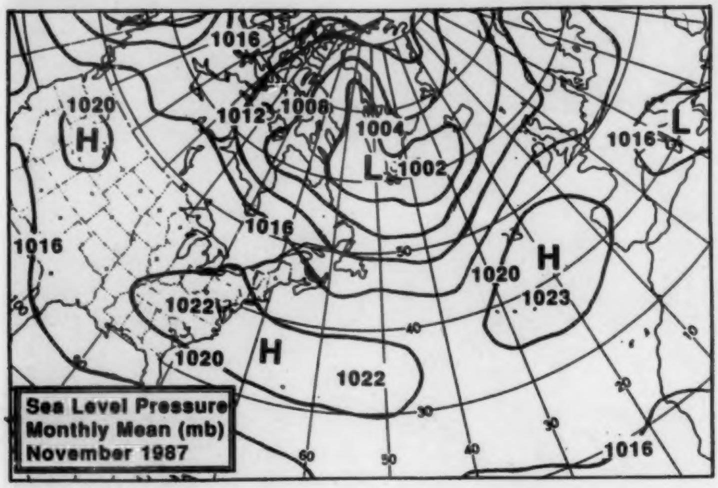


Figure 5.—Stronger than normal features dominate the chart.

strong high pressure systems over the central North Atlantic. Heavy rains over southeast Spain on the 3d and 4th caused extensive flooding and the loss of 16 lives. On the 21st heavy rains and 54-kn gusts struck Italy's Adriatic coast. Two fishermen drowned when their boat overturned in gales off the port of Bari. Northeasterly squalls hit the Great Lakes region on the 20th causing gales over Lakes Erie and Ontario. Lake City, MI was blanketed with more than 9 in of snow in less than 5 hr. Up to 18 in fell near Paradise in eastern upper Michigan.

This brief but potent storm was the product of a Low over the Grand Banks and a frontal wave to the east as the month opened. At 1200 on the 1st the ***Isolde*** (44°N, 47°W) encountered 46-kn westerlies in 13-ft swells. Six hr later several other vessels hit 40-to 45-kn winds while the ***Nuernberg Express*** reported a 52-kn blow with a 986-mb pressure in 26-ft seas about 120 mi southwest of the center. By 1200 on the 2d the central pressure of the northward moving storm had dropped to 969 mb. Just south of the center, at 1800, the ***Magnus Jensen*** clocked 60-kn southerlies with a 984.5-mb reading. The storm began to fill as it approached the Denmark St on the 3d, but gales continued to be reported throughout the day.

Another short-lived, severe storm came to life on the 11th, near 52°N, 27°W, at 0000. Some 12 hr later central pressure was down to 972 mb and its circulation was producing strong winds across the British Isles and south into the Bay of Biscay. The storm was heading for northern Scotland and the North Sea. Several vessels were reporting 40-to 45-kn winds east and west of England; these included the ***Koeln Express Boree, Hans Marchwitza*** and the ***Hawk Arrow***. By 1800 a flood of gale reports came in, and seas were running 13 to 20 ft. The ***Cote D' Azur*** near 51.0°N, 1.5°E reported 46-kn west southwesterlies, while nearby the ***Champs Elysees*** was battling 54-kn southwesterlies. The system moved across Scotland on the 12th and through the North Sea the following day. Its circulation, however, extended to Bay of Biscay to the south and gales were being reported 900 mi to the west of the center. Wind reports were consistently in the 40-to 50-kn range over the northwestern North Atlantic as well as the Norwegian and North Seas, through the 13th. The ***Volstad Jr*** (62°N, 5°E), at 1800, reported in with a 60 kn east northeast wind and a 981-mb pressure. However, as the system approached the coast of Norway it began to fill rapidly.

Monster of the Month - Known in some parts as the "Veterans Day Storm of 87" this system began just off Galveston, TX on the 9th. The following day it moved across the southeastern U.S. and by the 11th, Veterans Day, it moved out off Cape Hatteras, NC. The storm dumped some beneficial rains over the dry southeast; more than 3 in fell at Muscle Shoals, AL, and Tupelo MS. Ship reports of 40 to 45 kn began coming in late on the 11th off the South Carolina Coast. However, it was until the 12th that the storm really began to wind up at sea. By this time it had blanketed the middle Atlantic and northeastern States with snow. In the Washington, DC area up to 15 in of snow fell while close to a foot of snow was measured just south of Boston. The 9.7 in that fell in Providence, RI set a record for all of November. Eastport, ME recorded 8 in.

Back to sea; at 1200 on the 12th the DVVH, ***Jimnu Maru, Gypsum Countess*** and the ***Canada Marquis*** all reported winds of 50 to 55 kn, with pressures ranging from 985 to 998 mb, in seas up to 30 ft. These vessels were just southeast through southwest of the center, whose pressure was estimated below 976 mb. Winds in the 40 to 50 kn range were also quite common. Near 41°N, 68°W at 1800, the ***Americana*** reported a 60-kn northwesterly in 30-ft seas. The following day (fig. 6) the system moved across Newfoundland, still generating gale and storm force winds. At 00600 the VCYL (50°N, 60°W) reported a 55-kn northerly with a 981-mb pressure. Early on the 14th the ***Parallaks*** hit 50-kn southwesterlies well south of the center. By the 15th the storm was weakening but was absorbed by another Low, which proceeded northeastward into the Norwegian Sea.

In the wake of the previous monster another Low developed on the 16th near 52°N, 40°W. By the 17th at 1200 the central pressure was down to 967 mb. DSV C was close to the center at 0000 on the 17th and reported a 45-kn southwest wind with a 979-mb pressure, while fighting 25-ft seas. By 0600 everyone was getting into the act as winds ranged from 40 to 56 kn in seas up to 21 ft. Some of the vessels caught in the storm but still taking time to observe were the ***Polarnye Zori***,

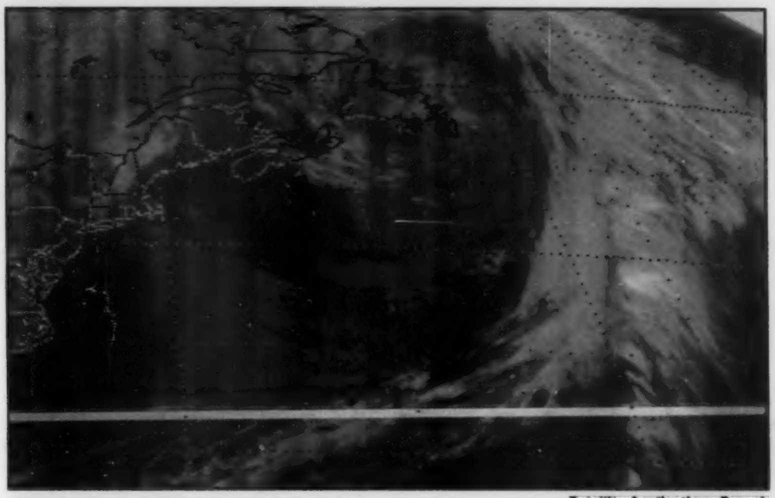


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Figure 6.—The Veterans Day storm moves across Newfoundland at 1300 on the 13th.

Atlantic Link, Koeln Express and the old reliable ***Sedco 710***. The central pressure dropped to 967 mb by 1200 on the 17th as the storm tracked northward. Some 200 mi to the southwest the ***June***, at 1800, reported a 60-kn northwest wind. OSV C was holding its usual station and still experiencing 40-kn winds in 23-ft seas on the 18th — never too many dull moments at 53°N, 36°W. Later in the day the 982-mb center moved across Iceland and headed northeastward. Frontal activity associated with the storm stretched to the Norwegian Sea where winds of 40 to 45 kn were being reported. The system eventually moved to near Spitsbergen, where it finally begin to fill on the 20th.

❺ The system began as a wave along a front south of Lake Michigan on the 25th. It moved off the New England coast on the 26th as not much of a system. In fact, on the 28th near 42°N, 45°W the central pressure was only 997 mb and the system didn't look too impressive on the charts. However, what a difference a day makes. By 1200 on the 29th the storm had wound up — pressure dropped to 976 mb, and was making waves in the shipping lanes. The ***Perth*** just north of the center, at 1200, reported a 60-kn northerly with a 984-mb pressure in 30-ft seas, which had a slope of about 1/5 — steep or breaking. This was verified by the ***Irma M*** (46°N, 39°W) 6 hr later; they encountered 60-kn westerlies with a 987-mb pressure. In general ships were reporting winds of 40 to 50 kn in seas of 15 to 25 ft. The storm continued to intensify and by 1200 on the 30th central pressure had dipped to 964 mb. Once again OSV C was part of the action with a 981-mb pressure in 41-kn winds and 23-ft seas at 0000 the 30th. Just southeast of the center at 1200 (fig.7) the ***Kaptanvassos*** reported southeasterlies at 60 kn with a 968.5- mb pressure. She was battling 33-ft seas with a slope of only 1/30. Six hr. later OSV C reported a 971-mb reading while roughing 33-ft seas. The system continued northward by the 1st of December began to fill.

Tropical Cyclones — About one tropical cyclone can be expected every 2 yr, on average in November. This year there were none for the second straight yr.

Casualties — On the 6th the barge ***Capital Maine 260***, pulled by the tug ***Jennifer C***, from Puerto Rico to Cartagena Colombia, suffered heavy weather damage as the entire starboard side of the cargo pen was destroyed. The ***Babor*** suffered damage on the 16th when she broke her moorings during high winds at Galveston , TX. Thu Humberside Coast Guard blamed fierce weather conditions on the 22d, in the North Sea, for causing the drilling platform rig ***Rowan Gorilla II***, to drift out of control for several hours. Two crewmen were thrown overboard but later rescued.

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Figure 7.—The 964-mb storm is spotted at 1330 on the 30th.

December, 1987—Just one look was all it took (fig 8) to discover what December was like over the North Atlantic shipping lanes. To the climatologist it was a picture perfect Icelandic Low dominating everything north of 30°N. To the mariner it spelled trouble. While the Icelandic Low is to be expected at this time of the year, the -17mb anomaly center near 45°N, 35°W indicates just how potent this system was. The anomalies spread out in a similar pattern to the system itself. Basically this means the lows were stronger or more numerous than normal, or both. For the most part it appears they were more intense. The 700-mb steering level indicates a slight cyclonic curvature to 40°W then becoming sharper to the east, so that a storm off Long Island might end up over Norway.

On This Date—December 26, 1947— New York City received a record snowstorm, which dropped 26 in in 24 hr; as much as 32 in fell in the suburbs. The heavy snow brought traffic to a standstill and caused 27 deaths.

Extratropical Cyclones — That it was a rough month is apparent from the average pressure chart. In addition to the storms over the major shipping lanes of the North Atlantic a blizzard roared through the Midwestern U.S. on the 15th creating havoc in the Great Lakes region. It closed down nearly everything in its path including Chicago's O'Hare Int. Airport. The storm, which also produced severe thunderstorms and triggered tornadoes across the south, has been blamed for at least 21 deaths since the 12th. It dumped up to a foot of snow from Missouri to the Great Lakes. In southern Wisconsin heavy snow was whipped by winds of 60 kn. On the 15th the ***Captain Yiannis*** was loading relief grain in Milwaukee's outer harbor when the high winds tore her loose. It took 4 hr for tugs to bring her under control after causing considerable damage.

❶ The first real storm of the month came to life on the 13th near 40°N, 65°W. Moving east northeastward it intensified slowly. By 1200 on the 14th it organized into a potent 966-mb Low. However, by 1800 on the 13th the ***Sealand Voyager, Rainbow Hope, Nedlloyd Hoorn, Sir Robert Bond*** and ***Pristina*** reported winds of 40 to 49 kn in seas of 12 to 30 ft, west of the center. At 1200 on the 14th the VSBS 6 encountered a 52-kn west southwesterly with a 975-mb pressure in 23-ft seas. Other vessels were reporting 42- to 48-kn winds farther away from the center. By the 15th the center, which was now heading northward was sporting a 862-mb pressure. Its circulation was covering a good portion of the northern North Atlantic. Winds of 45 to 50 kn were being reported by such vessels as the VSBJ, VSBN, ***Western Greeting, Galion*** and the ***Scottish Air***. Swells were running 20 to 26 ft. The system began to fill on the 16th and 17th.

❷ Monster of the Month— One week later the 23d another system came to life, some 250 mi. south of where the previous storm developed. Its track was also similar. However it intensified quickly. From 1200 on the 23d to 1200 on the 24th the central pressure dropped from 993 mb to 960 mb. This dramatic change was quickly noticed in the shipping lanes. The ***German Senator***, near 43°N, 47°W, ran into 64-kn north northwesterlies, while the ***Ernst Krenkel*** was nailed by 52-kn north northwesterlies while battling 33-ft swells some 240 mi. west of the center. Storm force winds were being sent in and a few approached hurricane force. The Britta Thein came in with 64-kn winds on both at 1800 and at 0000 on the 25th. She was fighting seas of 26 ft. By 1200 on the 25th the central pressure was down to 944 mb — a very potent storm (fig 9). The ***Britta Thien*** continued to battle 60-kn winds near 45°N, 44°W and the ***Atlantic Compass***, nearby ran into 63-kn winds in seas reported at 39 ft. The ***Kruswica*** confirmed the 39-ft seas and reported 58-kn northwesterlies. Of course OSV C didn't miss out on this storm as she hit 45-kn northerlies in 28-ft swells near 55°N, 40°W, and reported a 973.5-mb pressure at 1900. These poundings continued into the 26th as the storm turned a gradual counterclockwise loop just north of 55°N, and weakened.

❸ This storm began over Lake Huron on the 25th. It moved eastward and out to sea over Nova Scotia the following day. Between 1200 on the 26th and 1200 on the 27th the central pressure dropped from 993 mb to 970 mb and then plummeted another 20 mb during the next 24 hr. This was determined from a report by an unidentified vessel which reported a pressure of 952.7 mb while battling 41-ft seas. Some 240 mi to the south another report indicated a 967.5-mb reading. Once

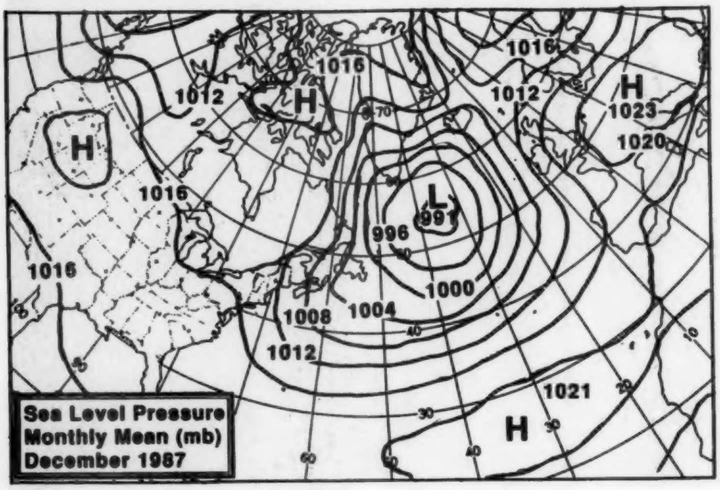

Figure 8.—The Icelandic Low dominates the chart.

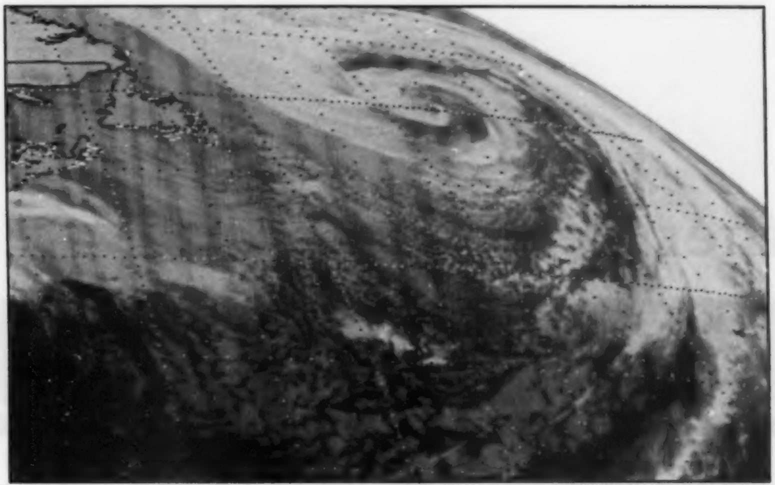

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Figure 9.— The potent 944-mb Low is caught at 1100 on the 25th.

again as in the previous storm the ***Atlantic Compass*** felt the sting as she ran into 52-kn south southeasterlies, near 50°N, 25°W, while coping in 23-ft seas. Storm force winds were becoming commonplace in this part of the Atlantic. Swells of 33 to 39 ft were being reported as the ocean boiled. At 0600 on the 28th gales were being reported as far west as 48°W by the ***Sedco 710***, with 40 kn, and as far east as 17°W by the ***Snow Crystal*** reporting 46 kn. At 1200 the ***Joh. Gorthon*** (51°N, 43°W) with a 978-mb pressure, reported 65-kn westerlies in 33-ft swells. By this time the 950-mb center was approaching the 60th parallel near 30°W. It soon began to slow and started to fill. Gales continued to blow on the 29th but storm force winds were not quite as common. However, at 1200 winds of 52 to 56 kn were still being reported by such vessels as the ***Asian Eagle, Francois Ld*** and the ***Debretsen***. By the 30th the weakening system had given way to another one farther to the south.

➓ This pre–New Year's storm formed on the 28th off Cape Hatterras, NC. It stayed well off the East Coast but intensified so rapidly — a 31 mb drop in 24 hr —that the storm produced a blizzard over Cape Cod on the 29th. Most of the northeast from northern New Jersey to New England was blanketed with 2 to 6 in of snow. Six inches fell at Boston and Providence and up to 13 in at Otis AFB on Cape Cod. Chatham on Cape Cod reported 3-ft drifts. On the 30th at 1200 the 958-mb storm, was approaching the Grand Banks (fig 10). At sea things weren't any better. About 120 mi northwest of the center the ***Saudi Riyadh*** was belted by 55-kn north northeasterlies in 20-ft swells in moderate rain showers. The ***Entalina*** (39°N, 69°W) suffered 62-kn northwesterlies in 16-ft seas while reporting moderate freezing rain. Several other ships were observing continuous heavy snow with visibilities down to 50 yd. At 1800 the ***Irving Nordic***, just west of the center, reported a 965-mb pressure in 50-kn northwesterlies. Winds continued to blow in the 40 to 50 kn range with seas ranging from 15 to 30 ft in some areas, through the 31st. At 1200 the ***Demiane Korottchenko*** was whipped by 56-kn west northwest winds just east of northern Newfoundland; her pressure was 984 mb. On New Years Day the storm began to fill as it headed toward Iceland. However it merged with another system and reintensified. To be continued in the next issue — a serial adventure.

Tropical Cyclones— On average a tropical cyclone develops in December about once in 14 yr. It did not happen this year. The last time was Hurricane Lilly in 1984.

Casualties — On the 15th the ***Triton Trader***, from New London to Israel, was reported listing heavily in 20-ft seas, 525 mi east of Cape Cod. The ***Frio***, Miami for Columbia, encountered heavy weather near Cay Sand and developed a 45° list, about 90 mi east of Cancun, Mexico. The crew was picked up by a Chinese freighter while the vessel sank 2 days later. On the 5th, a fire broke out aboard the ***Cason*** in rough seas off the coast of Spain; 22 crewmen died and 8 were rescued. Most of the fatalities were due to drowning or exposure to the cold waters. Later in the month salvage operations off Finisterre were delayed by rough weather, which included seas of 15 to 20 ft.

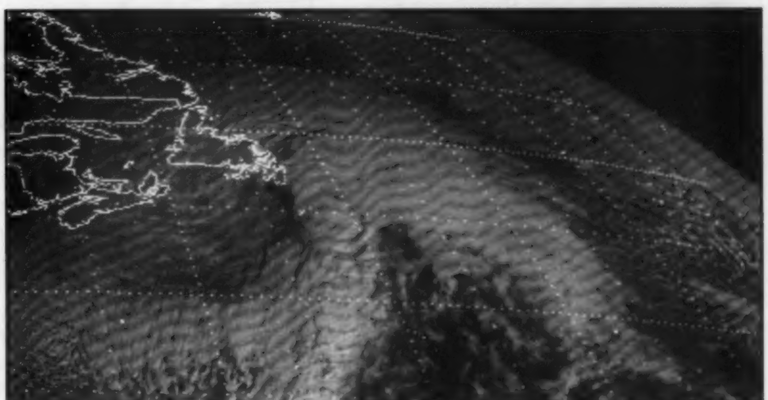

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Figure 10.— After blasting Cape Cod this storm tore up the Grand Banks on the 30th.

Marine Weather Review (cont'd)

October, 1987 — The Aleutian Low (fig 1) was a little stronger than average and west of its normal position in the Gulf of Alaska. The subtropical high was also more intense and its influence extended more to the northeast and west than it usually does. This resulted in a concentration of storm activity in the Bering Sea and the western Gulf of Alaska. This is supported by the 700 - mb upper level steering currents, which were zonal from Asia to about 160°W where they curved northeastward.

On this date — October 5, 1987 — In San Francisco, CA the hottest day in 113 yr of record keeping was observed as the mercury topped out at 102°F. This broke the old record of 101°F set on September 14, 1971. Monterey also set an all time record of 104°F.

Extratropical Cyclones— several extratropical cyclones contributed to activity this month and the southern Bering Sea and Aleutian Islands were the scene of some of the most intense storms. About eight or nine storms ended up in the Gulf of Alaska or over the Alaska Peninsula.

❶ The extratropical remnants of last month's typhoon Ian provided the impetus for this month's first major system. At 0000 on the 2d the ***Arafura*** (28°N, 144°E) encountered 49-kn winds from the south southwest in 13- ft. swells. The storm moved northwestward during the next few days continuing to generate gales and rough seas. The storm wasn't that intense but the pressure gradient was tight due to a squeeze put on by high pressure systems to the northwest and northeast. Vessels on the 3d and 4th to the north of the center were reporting winds in the 40 to 50 kn range with seas running 8 to 16 ft. It wasn't until the 5th as it reached the Aleutians that the system took on an identify of its own. The ***Bianca*** (51°N, 175°E) at 0000 on the 6th ran into 52-kn west southwesterlies in 26-ft seas. Central pressure was at 974 mb at this time and it was generating gales out to 600 mi. It skirted the Aleutians for the next several days, continuing to create problems over the northern routes. It finally moved inland over the Alaska Peninsula on the 10th

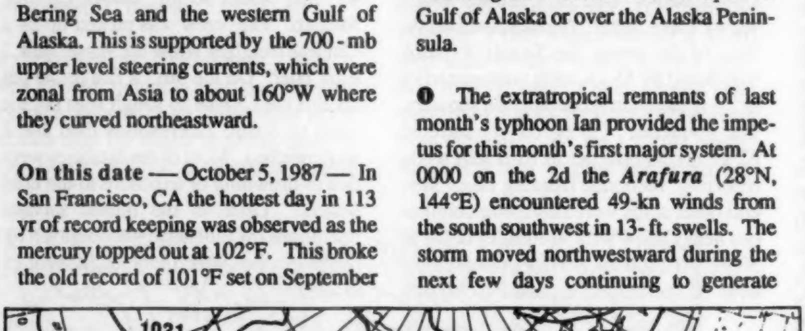

Figure 1.— October was a little more intense than normal.

❷ This was a short – lived but potent Gulf of Alaska storm. It came to life on the 3d near 39°N, 166°W and headed northeastward. The following day its central pressure had fallen to 975 mb and its circulation was dominating the Gulf. This was verified by the ***Arco Texas*** (54°N, 137°W) at 1800, on the 4th when she encountered 50-kn southeasterlies in 25-ft seas with a slope of 1/8 — steep. A report from the ***Amundsen Sea*** included a 985-mb pressure along with 63-kn easterlies. On the 5th at 0000 this was confirmed by the ***Texaco Connecticut*** (57°N, 141°W) which hit 65-kn northeasterlies and reported seas of 15 ft. In general winds were running 40 to 50 kn.

❸ Typhoon Kelly transformed into an

North Pacific Weather Log
October, November and December

intense extratropical storm off Kyushu, Japan on the 16th. The storm proceeded east northeastward across the Pacific, eventually recurving into the Gulf of Alaska and dissipating by the 22d. By the 18th ex-Kelley was making its presence known over the shipping lanes. At 0600 the ***Pavel Tchebotnyaguine*** clocked 45-kn northerlies near 44°N 148°E while rolling in 10-ft swells. To the east the ***Sealand Explorer*** spotted 16-ft swells in 40-kn winds. Six hr later the ***Sealand Freedom*** (45°N, 154°E) reported 50-kn north northeasterlies. By the 19th the 976-mb storm was crossing the dateline and a raft of ship reports came flooding in, with winds ranging from 40 to 55 kn and seas from 10 to 25 ft. The ELEK (43°N, 163°E) reported northwest winds at 50 kn in 25- ft seas at 0000. Some 19 vessels radioed gale or storm force winds during that reporting time. The system continued to intensify and by 1200 on the 20th pressure was down to 968 mb. At 0600 the ***Tagasan Maru*** (52°N, 168°W) reported a 980-mb pressure while battling 51-kn winds in 26-ft seas. At 1800 the ***Happy Buccaneer*** was dueling 60-kn west southwesterlies in 33-ft seas near 47°N, 160°W. The following day the system began to weaken as it headed northward to Alaska, but winds continued to blow at gale force for awhile.

❺ A wave formed along a stationary front just east of the Ryukyu Is on the 26th, as tropical depression Lynn was fizzling out to the southwest. This event was of no particular significance until the 29th when it suddenly organized and deepened. By 1200 the central pressure was at 972 mb as the storm neared the dateline at 45°N. At 1800 the ***Dubhe***, southeast of the center, hit 42-kn southeasterlies. Six hr later several vessels followed suit with reports of 40-to 45-kn winds and seas as high as 25 ft. However, this storm began to fizzle on the 30th and served mainly as a forerunner to the next system which was one of the month's worst.

❻ Monster of the Month— This baby began on the 28th northeast of Mongolia. Moving eastward it developed rapidly. In the Sea of Okhotsk on the 29th, at 1200, pressure was down to 982 mb; 24 hr later east of Kamchatka it was at 964 mb and raging. Most ships were reporting 40-to 50-kn winds from a safe distance. Those caught along the cold front were blasted by even higher winds. Those southeast of the center, like the ***Leda Maersk*** found themselves battling 25-ft seas . At 1800 on the 30th an unidentified ship in the southwest quadrant encountered a 60-kn west northwesterly in swells that had built to 20 ft. The ***Mys Orekhova*** and the ***Mys Ioudina*** both close to the storm's center reported nearly identical measurements of 50-kn winds and a 972-mb pressure. However, one reported seas of 10 ft and the other 23 ft; conditions and estimates can vary in a short distance. The ***Shinkakogawa Maru*** had a 2-day battle with the storm as she fought 60- to 70-kn winds in 13- to 25- ft swells over the 29th and 30th, while sailing in the system's southern quadrant. The 964-mb storm (fig 2) continued to rage through the 31st as it moved into the Bering Sea. The ***Giovanni*** close to the center, at 0600, recorded a pressure of 970 mb in 40-kn winds. Winds were stronger and waves higher farther south of the storm's center. At 1800 the ***Borissov***, which must have been very close to the storm's center, reported a 967..2 - mb reading while battling 62-kn winds in seas that were run-

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Figure 2.—The satellite provides a glimpse of this huge storm as it swirls across the Kamchatka Peninsula on the 30th.

ning only 2 ft. Since storms do not respect monthly divisions, November started out with a bang in the Bering Sea. The system although weakening, influenced the weather over the entire Bering Sea and along the northern routes for the first few days.

Tropical Cyclones— Four tropical cyclones developed in the North Pacific basin this month. In the west super Typhoon Lynn and Typhoon Kelly haunted western waters while Hurricane Ramon and Tropical Storm Selma roamed the east. A detailed account of eastern storms can be found on pg 12 of this issue, while the western summary will be featured in the Summer 1988 issue.

Hurricane Ramon was spotted on the 5th as a tropical storm nearly 400 mi south of Manzanillo. Moving northwestward it reached hurricane intensity at 1200 on the 7th. By 0600 on the 9th, 115-kn winds were blowing close to its center near 15°N, 114°W. Winds remained above 95 knots until 0600 on the 11th. However, the storm weakened rapidly after that. Tropical Storm Selma came to life on the 27th near 10°N,121°W. Tracking northward it became a tropical storm late on the 27th but fell back to depression strength the following day. By 1800 on the 9th she regained storm strength for a few hours but quickly faded as the month came to a close.

The real action was in the west. According to our friends at the Royal Observatory at Hong Kong, Kelly formed some 230 mi north of Yap Is on the 10th. He reached tropical storm strength early the next day and by the evening of the 12th was a typhoon. The Joint Typhoon Warning Center placed the storm at typhoon strength at 0000 on the 12th. Kelly peaked at 95 kn near the point of recurvature at 1200 on the 15th. He made landfall on the south coast of Shikoku late on the 16th and swept across the island during the early morning hours of the 17th. Torrential rains, up to 20 in, triggered some 400 landslides. Some 13 thousand homes were flooded and eight people were reported killed. An oil tanker in coastal waters near Shikoku was driven aground by winds which gusted up to 120 kn. After crossing Shikoku and Honshu, Kelly entered the Sea of Japan and became extratropical. He wasn't finished as is documented in the extratropical section.

About the time Kelly was turning extratropical, Lyn (Pepang) was coming to life some 700 mi east of Guam. It moved steadily westward for 2 days, intensifying to tropical storm strength at 0600 on the 16th. Lyn moved through the Mariannas on the 18th as a typhoon, reaching that plateau at 0000 on the 18th. It passed within 75 mi of Guam where sustained winds hit 36 kn with gusts to 57 kn at Agana. Apra Harbor was closed after four U.S. Navy ships sorted to open waters. Most villages on Guam reported flooding in low-lying areas and there was serious crop damage. Saipan and Rota both experienced island-wide power outages late on the 18th. Once past the Mariannas (fig 4) Lynn intensified rapidly from 80 kn to her peak of 140 kn, reaching super typhoon intensity just after 1800 on the 19th and remaining at this level until 0000 on the 21st.

DMSP visual imagery

Figure 3.—Typhoon Kelly at 0042 on the 15th.

The Joint Typhoon Warning Center provided excerpts from a merchant vessel's log.

"Sea and swell were of height and steepness that we couldn't turn around anymore... Seas approximately 2 1/2 times the bridge height and breaking all around us. At 1000 we recorded the lowest barometric pressure to 969 HPA, (approximately 75 mi from the center). During passage of "Lynn" visibility was reduced to 000.0 m. Wind above comprehension... our ears on the bridge were popping due to pressure change with pitching of vessel."

Early on the 24th Lynn was tracking through the Luzon St. From the 24th through the 26th she ravaged parts of Taiwan, where at least 42 people were killed in the areas worst flooding in 40 yr. This included nine school children, on a field trip, who were swept away by 20-ft storm waves in Hengchun. More than 100 fishing vessels were lost or damaged and the 110 thousand - ton freighter ***Barkla*** of Hong Kong ran aground in southern Taiwan. Lynn also brought torrential rain to northern Luzon, causing serious flooding and triggering landslides. According to press reports more than 60 people died. By early on the 27th Lynn degenerated to tropical storm strength then fell to a depression later in the day. She was heading towards Hong Kong at the time. The combination of Lynn's remnants and a strong northeast monsoon generated gusts to 56 kn in the Hong Kong area.

Casualties— The ***Stuyvesant***, caught in a Gulf of Alaska storm on the 3d, spilled about 15 thousand barrels of Alaska crude into the sea some 200 mi west of Queen Charlotte Is, Canada. On the 16th, in typhoon Kelly, the ***Eleftheria II*** ran hard aground on rocky bottom at Nunoshima, on Tokushima Prefecture. All 24 crewmen abandoned the vessel and were taken by fishing vessels to the nearest port. During typhoon Lynn the ***Kota Eagle*** and the ***Bismihita'la*** both reported heavy weather damage.

November, 1987— When the Aleutian Low and the subtropical high are more intense, or deeper, than normal, the pressure gradient between them becomes tighter and this usually re sults in a rough weather month. November (fig 4) was just such a month. The Aleutian Low was 5 to 9 mb deeper than normal while the subtropical high showed +3 to +5 mb anomalies. An additional squeeze was put on by the Arctic High, which was 8 to 9 mb deeper than average. Throw in a super typhoon and you've got a not so Pacific ocean. The steering currents at 700 mb were zonal from Asia to 150°W, where they bent or curved cyclonically northeastward.

On This Date—November 16, 1959— Typhoon Freda moved directly over Cataduanes Is in the eastern Philippines. The U.S. Coast Guard station there measured 130 kn before the equipment blew away. Observers estimated maximum gusts to have reached 165 kn. Freda left 58 people dead, two vessels were driven aground and a single-engine plane crashed during the strong winds.

Extratropical Cyclones— Storm tracks tended to be concentrated in the region covered by the Aleutian Low in figure 4. These are what make up the climatic features anyway, but the concentration is the impressive feature. This was due in part to the highs to the north and south.

❶ This Low developed in the Sea of Japan on the 4th. By the 6th it was well organized along the Kuril Is and generating gales to the south and southeast of its 992-mb center. Heading east northeastward it continued to develop. From such ships as the ***Zoubarevo, Century Leader No. 3, Badger*** and the ***Hyuga Maru*** it was obvious that winds were in the 40- to 45-kn range with seas running 8 to 12 ft. At 1800 on the 8th as the storm headed into the Gulf of Alaska the ***Mobil Meridian*** (50°N, 129°W) far to the east encountered 49-kn southeasterlies in 25-ft swells. This was confirmed 6 hr later by the ***Seto Maru***, nearby, which ran into 45-kn northeasterlies in 23-ft swells. This was confirmed 6 hr later by the Seto Maru, nearby, which ran into 45-kn northeasterlies in 23-ft swells. By 1200 on the 9th, pressure had fallen to 969 mb and the circulation covered the entire Gulf of Alaska. The strongest wind at this hour came in from the ***Don Carlos B-II***, which recorded a 47-kn southerly near 49°N, 129°W. For as deep as this storm was — dipping to 964 mb at 0000 on the 10th — winds were lighter than might be expected. The storm remained at this level into the 10th. However, by the 11th it began to fill rapidly.

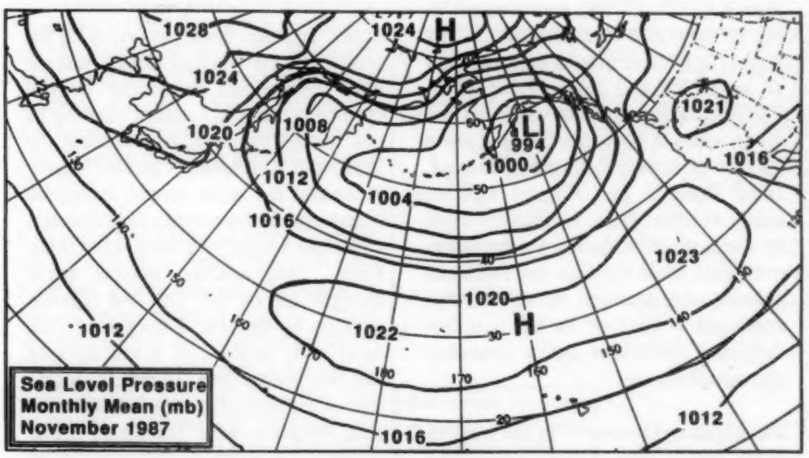


Figure 4.— All the climatic features were intensified this month.

❷ An atmospheric wave formed along a stationary front, on the 30th parallel, on the 16th. Moving north northeastward it began to intensify rapidly. By 0000 on the 18th, central pressure was down to 960 mb and storm force winds were being reported south and southeast of the center. A good indication of this storm's intensity was a report by the ***Young Soldier*** of a 980-mb pressure with 64-kn southeasterlies in 26-ft seas some 180 mi east of the center. The ***Professor Bogorov*** (43°N, 156°E) hit 56-kn northwesterlies in 33-ft seas. There were in large number of gale and storm force wind reports. Winds of 65-kn were reported by the ***Daiho Maru*** at 0600 in 30-ft swells, while the ELET hit 62-kn winds. Storm force winds continued throughout the day; at 1800 the ***Queen Opal*** battled 52-kn southeasterlies in 36-ft seas near 49°N, 179°E. The low continued northeastward into the 19th when it turned toward the east. At this time it also began to fill, but maintained its identity into the Gulf of Alaska on the 21st.

❸ While the previous system was fading in the Gulf of Alaska on the 21st, this incipient storm was making its appearance as a wave along a front, some 1700 mi to the southwest. However, it wasn't until the 23d that it began to look like a storm as it moved northeastward into the Gulf of Alaska. At 0000 on the 23d the central pressure was estimated at 982 mb; 12 hr later it was down to 960 mb and terrorizing the entire Gulf. It was a compact but intense system and gales extended out to 500 mi to the southwest. The ***Hyuga Maru*** near 50°N, 142°W reported gales in 12-ft seas while to the east another vessel reported seas of 20 ft. The storm moved ashore on the 24th.

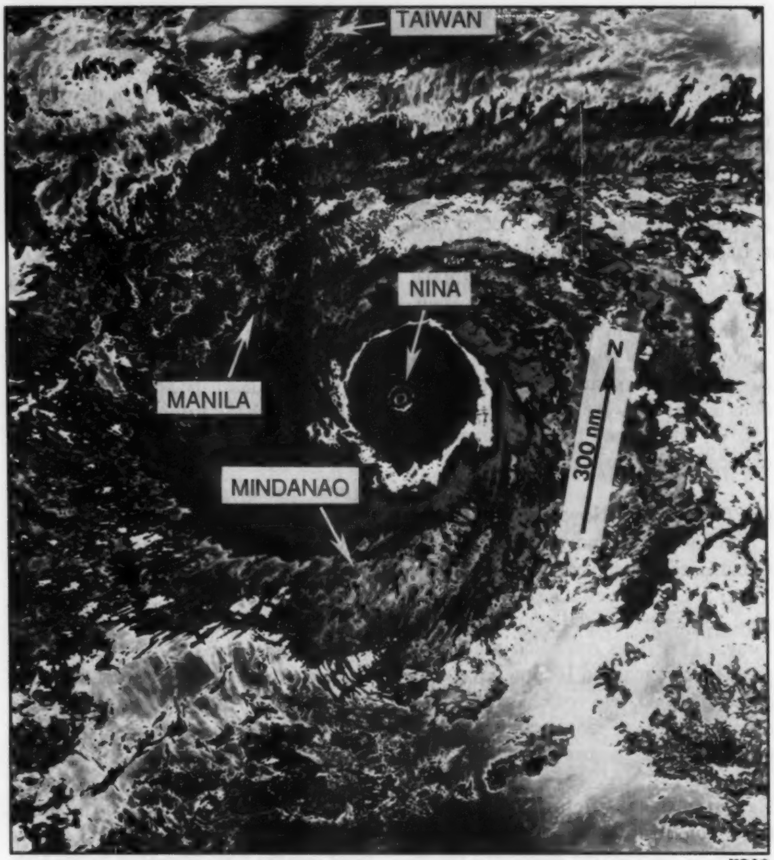
❹ While the previous storm was moving ashore, on the 24th, a short-lived little known system flared up near 40°N, 175°W. At 0000 on the 24th its central pressure was 968 mb, down from 990 mb the previous day. However, on the 1200 chart it showed up a 949 mb— a very intense system. However, there seemed to be little evidence from ship reports to confirm such an extreme. The ***Alexanderturm***, some 400 mi to the south of the center, reported 42-kn westerlies with a

992-mb pressure. At 1800 the ***Leda Maersk*** near 47°N, 162°W reported a 42-kn wind and a 982-mb reading, and 6 hr later several vessels reported winds in the 45– to 50– kn range. However, the lowest reported pressure was 979 by the ***Prince of Tokyo*** some 100 mi southwest of the center. By 1200 on the 25th central pressure was estimated at 976 mb and the following day this mysterious storm was gone.

● On the 27th a small atmospheric wave was analyzed near 43°N, 148°E with the aid of several ship reports. The reports were not spectacular but the wind directions and shifts enabled forecasters to pinpoint this circulation. The ***Michigan Highway*** provided a key observation. The system developed slowly as it meandered east northeastward. At 0000 on the 30th the ***President Garfield*** gave a good indication that the storm was deepening significantly, when it radioed in 52-kn westerlies with a 990-mb pressure in 20-ft seas, near 45°N, 168°W. By 1200 the 966-mb storm center was moving into the Gulf of Alaska. At 1800 the 3ESC provided a great pressure measurement of 968 mb very close to the center. Now the Gulf of Alaska was coming to life. Several vessels reported winds in the 40- to 50-kn range; swells ranged up to 26 ft. At 0000 on December 1st the ***Queen of the North*** (53°N, 132°W) measured a 976-mb pressure in a thunderstorm. A key report (fig 5) came in from the ***Sansinea II*** on the 30th and the 1st of December. The note indicates that the vessel ran into 70-kn winds in 40- to 50- ft seas at about 2300 on the 30th. The ***Cambell Island,*** Hong Kong to Los Angeles suffered heavy weather off the Washington coast on about the 30th, losing 11 containers overboard while the ones that remained onboard were damaged. Rough weather continued in the Gulf for the next few days until this system finally weakened and moved ashore.

Tropical cyclones— In the western North Pacific those tropical storms and one super typhoon developed in November. The east was quiet except for a brief topical depression on the 24th and 25th.

Super Typhoon Nina, according to the Joint Typhoon Warning Center, was the most intense and destructive tropical cyclone of the 1987 season. During its trek toward the west, it devastated the Truk Atoll in the eastern Caroline Islands, decimated the north central Philippine Islands and then executed a final dramatic loop in the South China Sea south of Hong Kong. She reached tropical storm strength late on the 19th and typhoon intensity by the 21st. Nina passed Truk Atoll early on the 21st. It was reported that five people died, 38 were seriously injured and most of the more than 40 thousand residents were homeless. Nina passed 60 mi north of Ulithi and 95 mi north of Yap on the 22d. She had slowed down, but approaching the Philippines



NOAA

Figure 6.— Satellite imagery shows the well–defined eye of Super Typhoon Nina as she approaced the Philippines on the 25th at 0700.

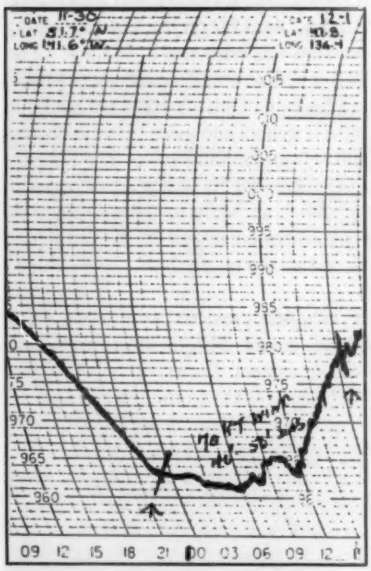


Figure 5.—** A barograph trace from the* ***Sansinena II.

she began to accelerate and intensify rapidly. By 1200 on the 24th Nina began to deepen explosively. She hit the southern tip of Luzon on the 25th (fig 6) with maximum sustained wind estimated at 145 kn with gusts to 175 kn. At least 687 people perished in the north central Philippine Is. She entered the South China Sea with 95-kn winds, but they increased to 100 kn shortly. The 500-ton ***Amizo III*** and tug boat ***JT II***, with two light barges, were reported missing. The ***Central Luzon*** was abandoned by its crew and two other vessels were driven aground. On the 29th Nina weakened into an area of low pressure near Dongsha and finally dissipated.

Maury was a weak, but persistent tropical storm that tracked westward across the Philippine and South China Seas. It was the second system of the year to regenerate over water. Maury formed about 300 mi southeast of Guam in early November but intensified only slightly from the 7th through the 10th, It was a tropical depression for less than 24 hr on the 11th and then fell apart. However, it regenerated on the 13th and became a tropical storm at 1200 on the 16th in the South China Sea. Maximum winds climbed to 45 kn at 0600 on the 17th. It made landfall over the southeast coast of Vietnam on the 19th where, accordingly to press reports, Maury caused widespread damage and at least 86 deaths.

Ogden popped up on the 30th as a poorly organized area of convection just east of the Philippines. He became a depression on the 24th some 150 mi off the coast of southern Vietnam. Ogden reached a maximum intensity of 45 kn late in the day, just prior to making landfall south of Tuy Hoa.

Casualty Reports— During Typhoon Nina, 22 mi from Hong Kong, a Danish container vessel rescued 10 survivors from a vessel believed missing. There was not a trace of the vessel reportedly on fire and adrift in heavy seas, some 240 mi south of Hong Kong on the 27th. The ***Salvador*** capsized near Batangas, another fishing vessel ran aground on Mindoro Is while a third ran aground on Simara Is.

On the 28th in the East China Sea the ***Kakas***, loaded with logs sank some 200 mi east of the Kusagaki Is. Eighteen of the crew of 20 were rescued with one body found and one missing. The ***Monterey*** a passenger vessel sailing from the Columbia River to the Gulf of Mexico ran into severe gale conditions on its voyage, while being towed.

December, 1987— This month usually features an extensive double-centered Aleutian Low with a relatively small subtropical high between Baja California and Hawaii. This year the Aleutian Low was more intense than normal with anomalies of up to -12 mb in the Bering Sea and -2 to -4 mb in the northern Gulf of Alaska. To the south high pressure extended into the western Pacific (fig 7) resulting in anomalies up to +8 mb. The steering currents at the 700 -mb level were in general oriented from the west southwest to the east northeast.

On This Date — December 9, 1961 — Typhoon Ellen passed with 10 mi of the northern tip of Catanduanes Is, with an eye that was 36 mi in diameter. The Coast Guard Loran Station received the impact of strong winds associated with the wall cloud, twice. Between 0715 and 0800 winds were estimated at 120 to 150 kn. They dropped to light at 1000, in the eye, with a lowest pressure of 948.5 mb. By 1430 winds were estimated at 130 to 160 kn. The damage was extensive and due to high winds, flying objects, flooding and rain.

Extratropical Cyclones— This month's storms were potent and concentrated along the northern shipping routes to and from Japan. Those routes between the Philippines and the West Coast were mostly south of the more intense activity although some gales did extend south of 40°N. Hawaii suffered a disastrous New Year's Eve and Day when up to 20 in of rain innundated Oahu Is. Flooding and mudslides were extensive. The heaviest damage occurred in residential area of East Honolulu and in the nearby city of Kailua. Damage was estimated at $29 million.

❶ This storm began to develop as the month opened, some 200 mi southeast of Tokyo. It moved northward, then east northeastward. By the 2d central pressure had fallen to 970 mb but rose to 976 mb the following day, before the system crossed the dateline, near 50°N. By 1200 on the 4th the pressure had fallen to 962 mb; 24 hr later was down to 948 mb and the system was dominating the Gulf of Alaska (fig 8). At this time, 1200 on the 5th, the Te He Hai, some 300 mi northeast of the center, was reporting 50-kn easterlies in 30-ft swells, with a 979-mb pressure. Six hr later the ***Koggegracht***,

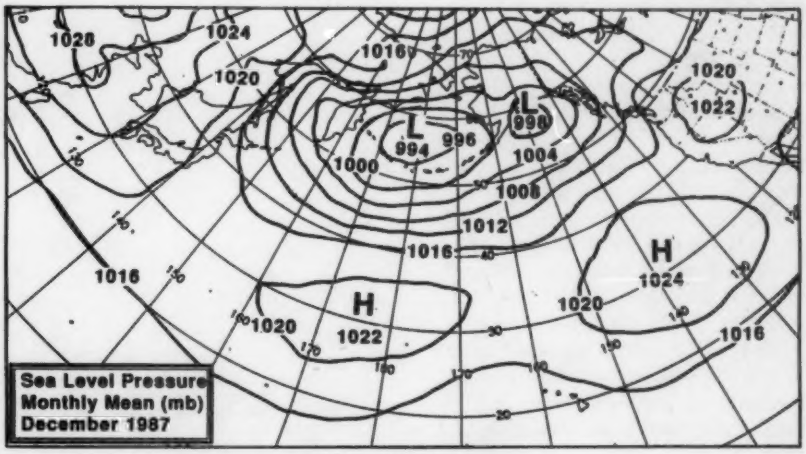
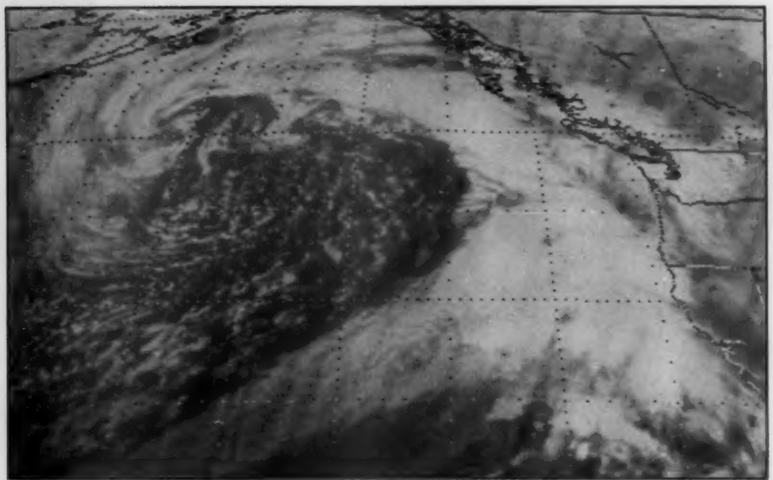


Figure 7.—This month features an intense Aleutian Low.



Sattelite Applications Branch

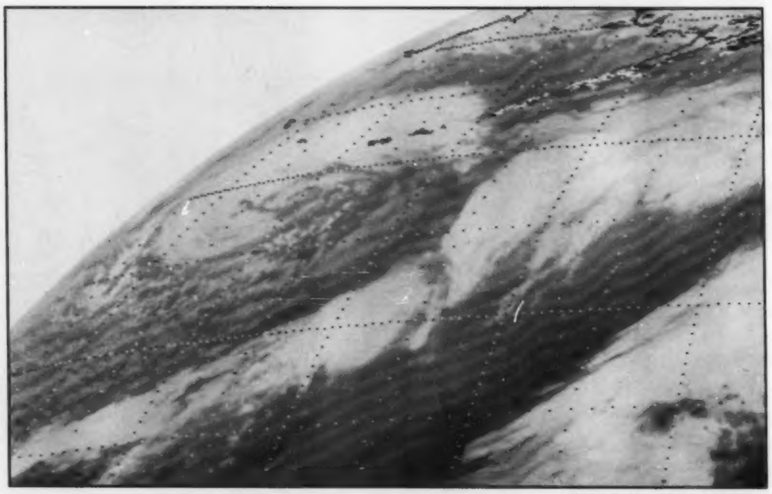
Figure 8.— The storm dominates the Gulf of Alaska at 0900 on the 5th.

Mobil Meridian, Mobile Kestrel, America Sun, Sohio Resolute, Tatekawa Maru and the LADC all encountered 48- to 55-kn winds with seas ranging from 15 to 30 ft and pressures from 966 mb to 978 mb. This storm continued to pound the Gulf of Alaska as it recurved toward the northwest and began to fill. It wasn't until the 7th that pressure rose above 970 mb and storm force winds began to subside.

● By the time the previous system began to fill , this storm was already becoming mature. At 1200 on the 6th it was a 990-mb Low tracking rapidly northeastward. By 1200 on the 7th its central pressure had plummeted to 958 mb— a 32 mb drop. It had also turned eastward. At 1200 the STOR (45°N, 173°E) hit 50-kn winds in 23-foot swells, with a 981-mb pressure. At 0000 on the 8th, the ***Tone Maru***, northwest of the center, reported 52-kn winds in 23-ft swells. On the 8th the 953-mb storm moved into the Gulf of Alaska— the second intense system within 4 days to dominate these seas. Winds in general were blowing at 40 to 50 kn. The ***Kruszwica*** (49°N, 135°W) was belted by 53-kn winds and reported a 970-mb pressure. Seas were running 15 to 15 ft. Like the previous storm this one also recurved, but farther eastward. It finally ran aground on the 11th east of Anchorage.

● This storm came to life on the 16th off Sakhalin in the Sea of Okhotsk. It deepened rapidly between the 17th and 18th when pressure fell from 982 mb to 958 mb (fig 9). Was it affecting shipping? At 0000 on the 18th more than 30 reports were radioed in continuing winds of 40 kn or more, seven of them had winds of 50 kn or more and four o f them winds of 60 kn or more. These four vessels were the ***Fort Yale***, JBWU, ***Masslot*** and an unidentified vessel. Seas were running about 15 to 25 ft. The storm tracked northwestward into Bering Sea but remained potent. However it moved far enough away from the major shipping lanes that winds along these routes dropped to below storm force. Gales were still reported as the 964-mb Low moved towards Kuskokwim Bay off southwest Alaska on the 19th. By the 20th it was inland and herding northeastward across Alaska.

● In the Sea Of Japan on the 25th, this system developed as a wave along a front. Moving east northeastward it intensified rapidly. By 1200 on the 26th pressure was down to 980 mb from 1003 mb 24 hr before. On the 26th the Low turned northeastward and headed toward the Bering Sea. A report from the ***President Washington*** (52°N, 166°E) at 0000 on the 26th included a 55-kn wind in 26-ft seas. At 1200 the ***On Wo*** some 240 mi southwest of the center hit 48-kn westerlies in 16- ft seas. The ELAV, at 0000 on the 27th near 45°N, 172°E ran into 56-kn west northwesterlies in 18- ft seas with a slope of about 1/11. These conditions occurred during a thunderstorm. The ***New York Maru***, not too far away in a shower, reported 45-kn westerlies. At 0000 on the 28th the ***Maersk Tacoma*** (52°N, 179°W) encountered 60-kn south southwesterlies in 33- ft seas, and the ***Queen Opal***, close by, verified that with a 52-kn south wind report in 21-ft seas.



Satellite Applications Branch

Figure 9.—This potent storm is seen on the 18th at about 1200. The central pressure was at 958 mb.

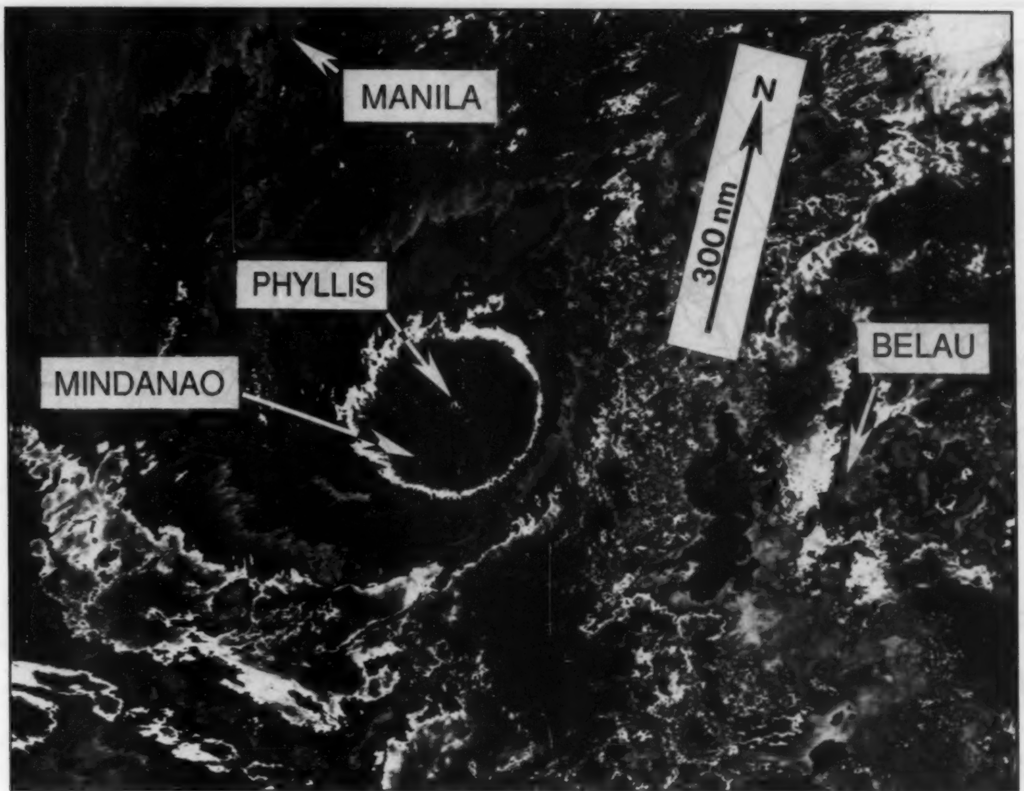


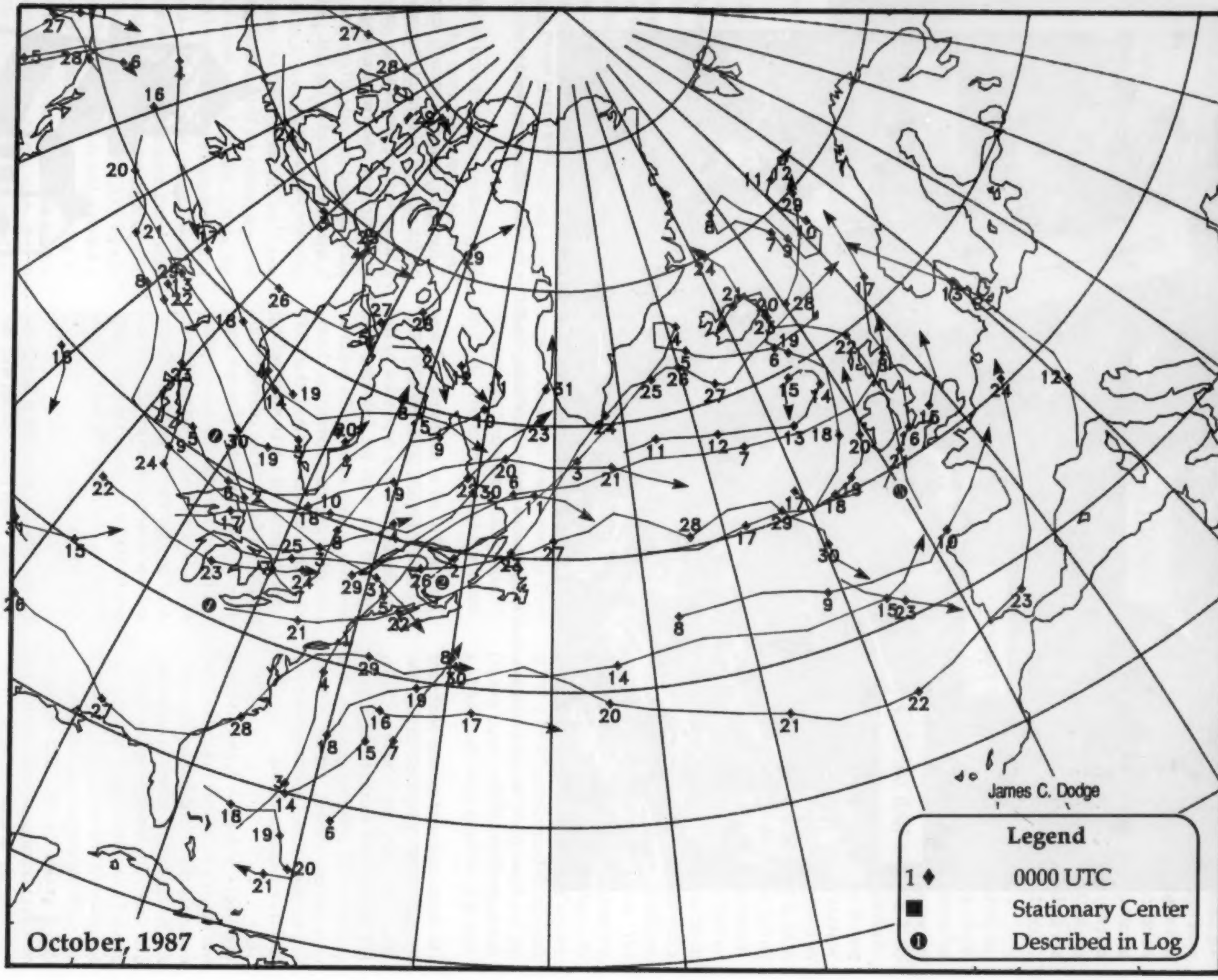
Figure 10.—The tightly wrapped, small eye of Typhoon Phyllis is seen making landfall on the island of Samar on the 15th just before 2200.

The storm continued to head northward but gale reports continued through the 28th. At 1800 the ***Unison*** (50°N, 175°W) was still encountering a 50-kn southerly with a 985-mb pressure, in a moderate rain shower. On the 29th the 982-mb storm turned northwestward and landed over eastern Siberia.

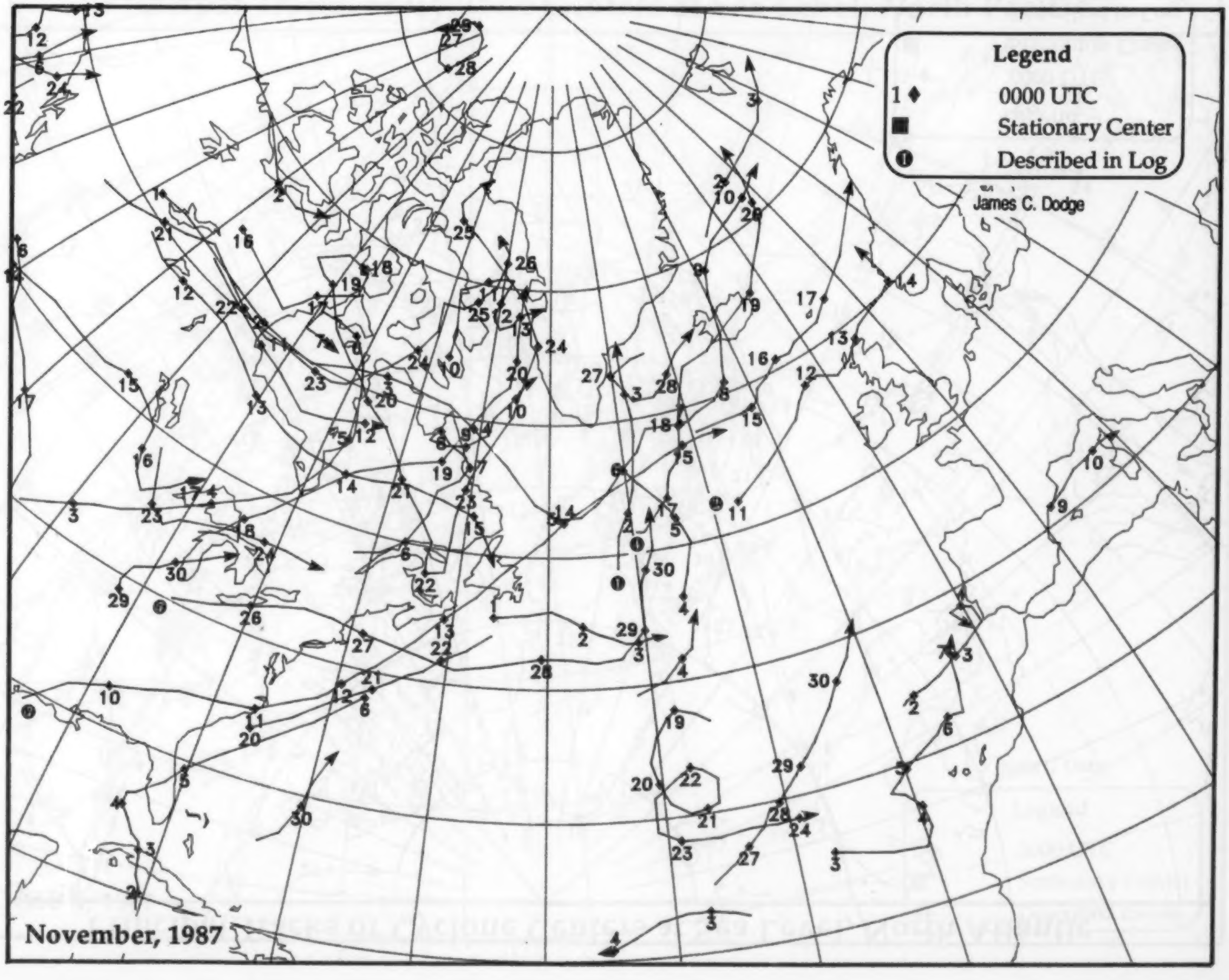
Tropical Cyclones - Typhoon Phyllis was the only significant tropical cyclone to develop in the North Pacific this month and the third of the season to regenerate over water. She struck the central Phillippine Is 3 weeks after Super Typhoon Nina and added further misery to that ravaged nation. Phyllis began in the eastern Caroline Is around the 9th. She organized enough to be called a depression late the following day as it passed some 370 mi south southeast of Guam. Twenty-four hr. later it made its closest approach to Guam at 210 mi to southwest and was upgraded to tropical storm intensity. She was downgraded to a depression by the 13th and lost it all the following day. However, within 18 hr Phyllis began to reestablish its central convection. Intensification continued until the 15th at 0000 when she peaked at 100 kn while making landfall on Samar in the central Philippines (fig 13). Phyllis left 10 people dead and 13 more were listed as missing when a ferry boat sank off of northern Samar. After peaking Phyllis weakened slowly and was downgraded to tropical depression by 000 on the 18th. Over the South China Sea, she did briefly reintensity to 35 kn on the 19th.

Casualties— On the 9th at Seattle the California Venus made contact with the JSS Los Angeles while approaching berth during heavy winds. The Jang Young No. 2, Basan for Hamada reportedly sank on the 6th about 38 mi north of Okinoshima in heavy weather; one crewman was rescued but eleven others were missing. The Allishan listed seriously off the Senkaku Is and then capsized on the 22d. All 13 crewmen were rescued.

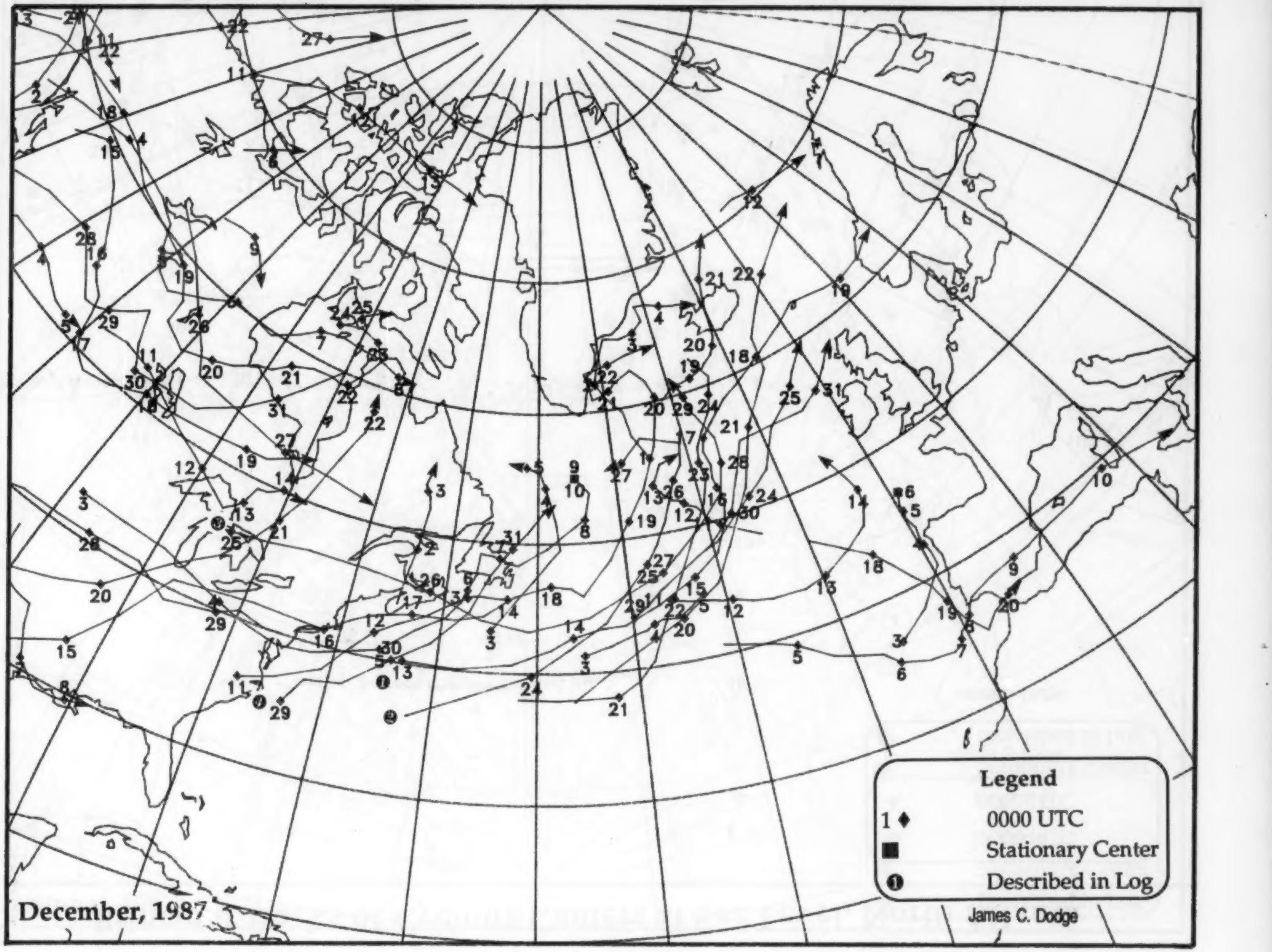
Principal Tracks of Cyclone Centers at Sea Level, North Atlantic



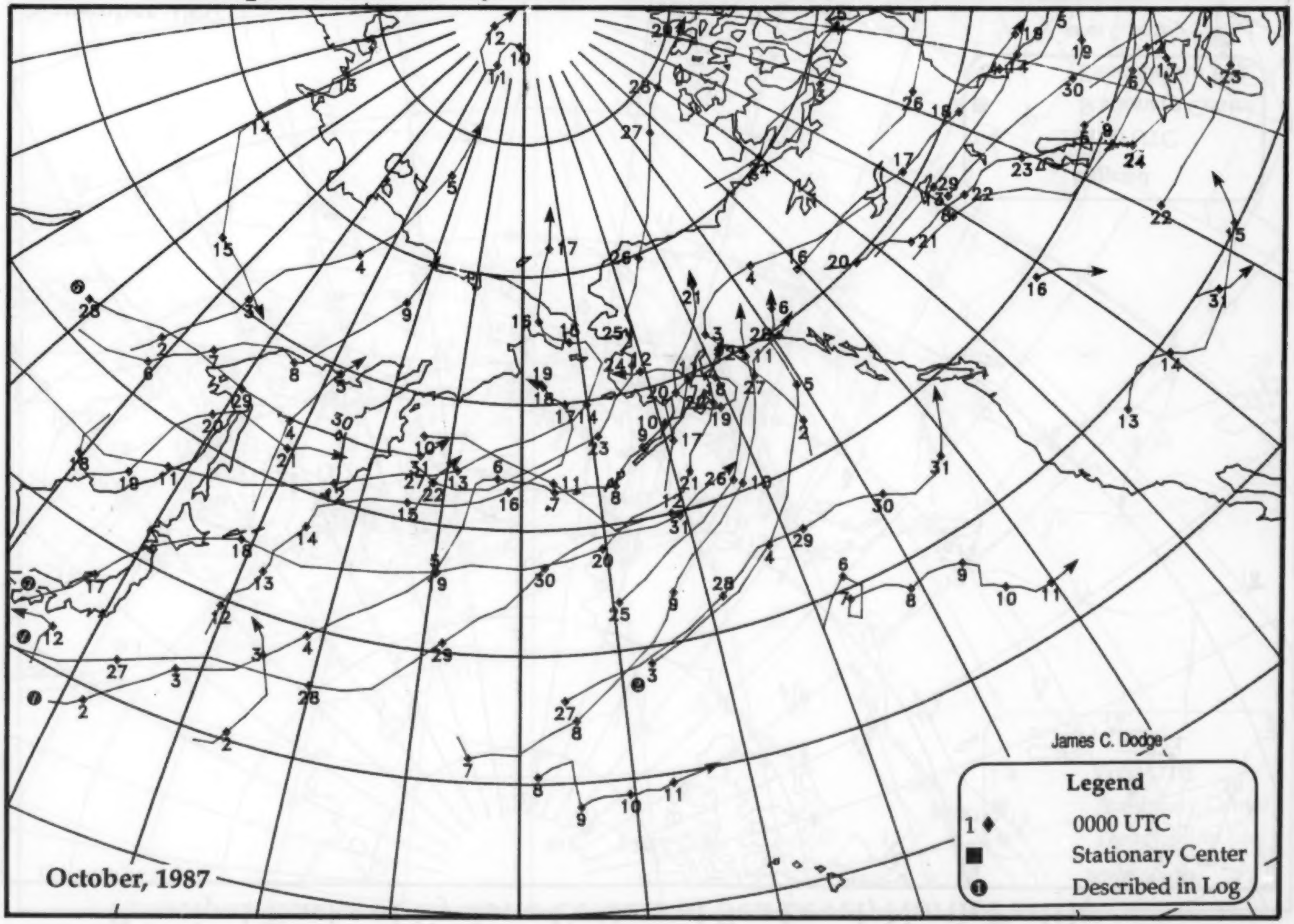
Principal Tracks of Cyclone Centers at Sea Level, North Atlantic



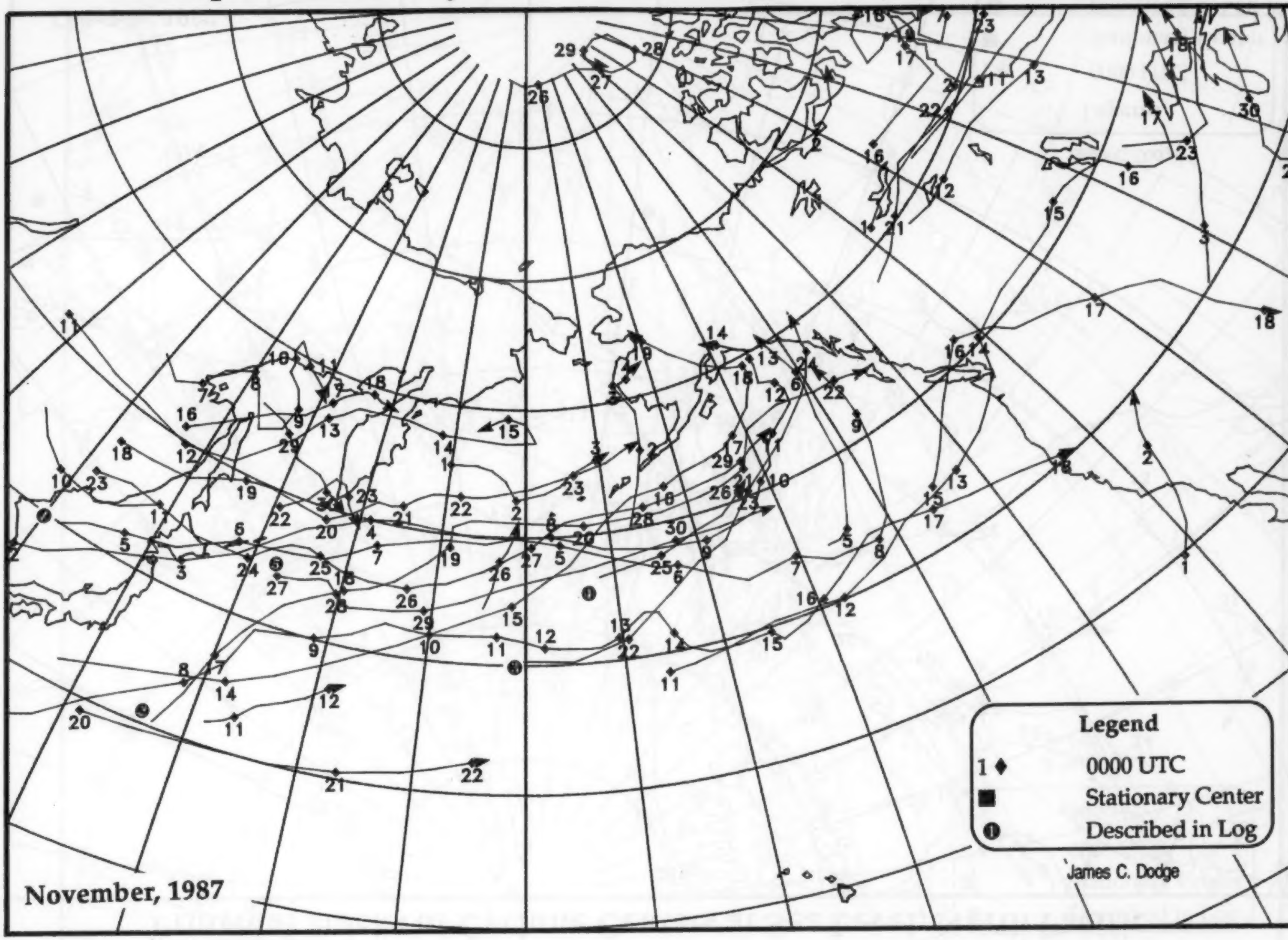
Principal Tracks of Cyclone Centers at Sea Level, North Atlantic



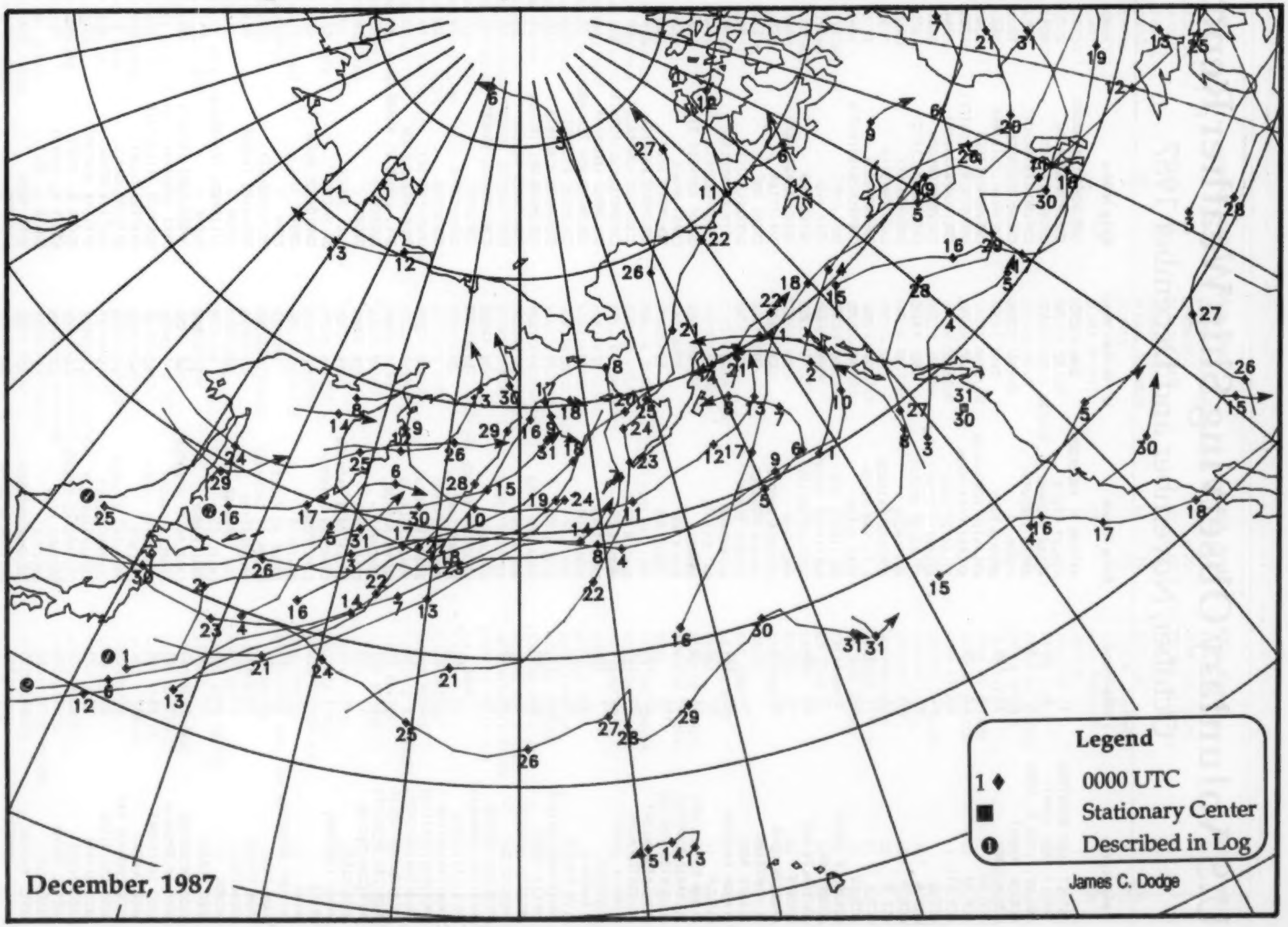
Principal Tracks of Cyclone Centers at Sea Level, North Pacific



Principal Tracks of Cyclone Centers at Sea Level, North Pacific



Principal Tracks of Cyclone Centers at Sea Level, North Pacific



U.S. Voluntary Observing Ship Weather Reports

October, November and December 1987

Ship Name	radio	mail
1ST LT ALEX BONNYMAN	16	
1ST LT JACK LUMMIS	2	21
2ND LT. JOHN P. BOBO	17	8
ACADIA FOREST	22	
ACE ACCORD	77	139
ACT 10	2	
ACT 11	47	77
ACT 111	44	
ACT 5	64	
ACT 6	87	
ACT 7	48	
ACT 9	66	
ACT I	111	
ACT IV	10	
ADABELLE LYKES	6	
ADDIRIYAH	2	
ADMIRALTY BAY	58	104
ADONIS	2	22
AFRICAN FERN	20	18
AL AHMADIAH	1	
ALASKA MARU	56	
ALASKA RAINBOW	15	124
ALBULA	57	37
ALDEN W. CLAUSEN	36	72
ALEMANIA EXPRESS	69	
ALLIGATOR FORTUNE	118	
ALLIGATOR GLORY	42	180
ALLIGATOR HOPE	71	145
ALMERIA LYKES	46	127
ALMUDENA	1	104
ALTAMONTE	21	35
ALVA MAERSK	45	139
AMBASSADOR BRIDGE	140	111
AMELIA TOPIC	35	48
AMERICA EXPRESS	56	
AMERICA SUN	36	58
AMERICAN CONDOR	14	
AMERICAN CORMORANT	4	
AMERICAN EAGLE	50	65
AMERICAN FALCON	13	129
AMERICAN HERITAGE	22	
AMERICAN MARINER		50
AMERICAN REPUBLIC		84
AMERICAN RESOLUTE	38	63
AMERICAN TROJAN	12	29
AMERICANA	9	54
AMOCO YORKTOWN	1	
ANITA	4	
ANONA	1	
ANTHONY RAINBOW	16	65
AQUA CITY	92	200
AQUA GARDEN	74	155
AQUARIUS	61	158
ARCHON	14	35
ARCO ALASKA	19	39
ARCO ANCHORAGE	29	40
ARCO CALIFORNIA	34	45
ARCO FAIRBANKS	23	40
ARCO JUNEAU	32	66
ARCO PRUDHOE BAY	29	26
ARCO SAG RIVER	29	44
ARCO SPIRIT	23	23
ARCO TEXAS	18	21
ARCTIC TOKYO	3	180
ARGONAUT	11	24
ARILD MAERSK	60	130
ARMAND HAMMER		163
ARMCO	173	278
ARNOLD MAERSK	16	60
ARTHUR M. ANDERSON	186	255
ASHLEY LYKES	12	74
ASIAN HIGHWAY	50	52
ASIAN VENTURE	6	
ASPEN	54	115
ATIGUN PASS	109	137
ATLANTIC COMPANION	49	
ATLANTIC RAINBOW	47	79
ATLANTIC SAGA	23	
ATLANTIC SONG	10	
ATLANTIC SPIRIT	32	148
AUSTANGER	8	74
AUSTRAL RAINBOW	24	26
B.T. SAN DIEGO	69	259
BAAB ULLAH	29	78
BALTIMORE SEA	12	19
BALTIMORE TRADER	41	42
BANGLAR KALLOL	3	80
BAR' ZAN	29	84
BARBARA ANDRIE	53	151
BARBER PERSEUS	50	
BARBER TAMPA		30
BARRYDALE	40	
BAY BRIDGE	58	31
BAYANI	9	65
BCR KING	38	
BEAUTEOUS	12	
BELLE RIVER		41
BENSON FORD		113
BERNINA	6	75
BHARATENDU	2	
BHAVABHUTI	9	
BIBI	83	
BISLIG BAY	99	
BOGASARI LIMA	59	129
BORINQUEN	37	131
BRINTON LYKES		2
BROOKLYN	19	142
BROOKLYN BRIDGE	36	33
BROOKS RANGE	29	58
BUNGA KENANGA	8	
BUNGA KESIDANG	48	225
BUNGA MELAWIS	10	
BURNS HARBOR		337
C.MEHMET	9	44
CALCITE II	133	196
CALIFORNIA RAINBOW	35	48
CANADIAN RAINBOW	18	79
CAPRICORN	51	143
CARIBE 1	28	92
CARLA A. HILLS		151
CASON J. CALLAWAY	117	169
CELEBRATION	14	78
CGM LORRAINE	32	
CHABLIS	1	3
CHALLENGER	52	179
CHARLES M. BEEGHLEY	54	124
CHARLES PIGOTT	1	58
CHARLOTTE LYKES	90	69
CHELSEA	30	122
CHEMICAL PIONEER	48	120
CHERRY VALLEY	15	57
CHESAPEAKE BAY	43	123
CHESAPEAKE TRADER	44	62
CHESNUT HILL	27	58
CHESTER	35	27
CHEVRON ANTWERP	12	102
CHEVRON ARIZONA	54	172
CHEVRON BURNABY	30	96
CHEVRON CALIFORNIA	111	151
CHEVRON COPENHAGEN	21	
CHEVRON EQUATOR	2	74
CHEVRON FELUY	101	91
CHEVRON FRANKFURT	4	
CHEVRON LONDON		180
CHEVRON LOUISIANA	42	104
CHEVRON METEOR	34	187
CHEVRON MISSISSIPPI	76	127
CHEVRON NAGASAKI	24	190
CHEVRON OREGON	114	197
CHEVRON PACIFIC	41	103
CHEVRON SKY		245
CHEVRON STAR	5	64
CHEVRON SUN		191
CHEVRON WASHINGTON	24	89
CHI JIN	17	
CHIA FU	37	49
CHICKASAW	5	43
CHIKUMAGAWA MARU	14	
CHRISTINA	75	
CHUEN ON	21	
CITADEL HILL	96	
CITY OF MIDLAND	9	112
CO-OP EXPRESS I	14	
CO-OP EXPRESS II	28	
COAST RANGE	25	69
COLUMBIA STAR	26	245
COLUMBUS AMERICA	212	
COLUMBUS AUSTRALIA	98	
COLUMBUS CALIFORNIA	100	
COLUMBUS LOUISANA	44	
COLUMBUS NEW ZEALAND	72	
COLUMBUS VICTORIA	136	
COLUMBUS VIRGINIA	115	
COLUMBUS WELLINGTON	61	
CONTENDER ARGENT	23	
CONTINENTAL LOTUS	12	
CONTINENTAL TRADER	12	
COPIAPO	1	
CORNUCOPIA	53	171
CORONADO	20	95
COUNTESS SKY	16	54
COURTNEY BURTON	60	58
CPL. LOUIS J. HAUGE JR	14	23
CURRENT	22	60
CYGNUS	51	87
D.L. BOWER		190
DA MOSTO	10	46
DAMIOS DE GOIS	42	
DANAH	31	58
DAWN	102	154
DELAWARE BAY	67	155
DELAWARE TRADER	88	36
DIANA	8	23
DILIGENCE TRADER		125
DUBHE	51	223
DUSSELDORF EXPRESS	34	
DYVI SKAGERAK		69
EASTERN FRIENDSHIP	19	86
EASTERN GLORY	29	61
EASTERN GRACE	1	
EASTERN ROYAL	46	21
EASTERN VENTURE	33	184
EDGAR B. SPEER		187
EDGAR M. QUEENY	28	
EDWIN H. GOTT		152
ELBE MARU	122	
ELGAREN	108	
ENDEAVOR	18	25
ERNEST R. BREECH	88	187

Ship Name	radio	mail
EVER BETTER		44
EVER GAINING		26
EVER GATHER	6	14
EVER GENERAL	5	5
EVER GENIUS	13	
EVER GENTLE	4	4
EVER GENTRY	16	29
EVER GIANT		57
EVER GIFTED	20	36
EVER GIVEN	6	3
EVER GLEAMY	11	29
EVER GLOBE	15	11
EVER GLORY	38	32
EVER GOING	1	
EVER GOLDEN	6	8
EVER GOVERN	12	71
EVER GRACE	13	2
EVER GROUP	8	
EVER GROWTH	6	17
EVER GUARD	19	21
EVER GUEST	10	
EVER GUIDE	19	29
EVER LEVEL	25	17
EVER LINKING	20	26
EVER LIVING	8	17
EVER LOADING	83	173
EVER LYRIC	79	68
EVER SHINE	16	
EVER SPRING	33	21
EVER SUMMIT	5	80
EVER SUPERB	9	7
EVER VALOR	22	55
EVER VALUE	50	92
EVER VIGOR	9	
EVER VITAL	32	63
EXPORT CHAMPION	17	
EXPORT FREEDOM	39	81
EXPORT PATRIOT	23	71
EXXON BALTIMORE	4	
EXXON BATON ROUGE	48	52
EXXON BAYTOWN	3	25
EXXON BENICIA	40	61
EXXON BOSTON	44	84
EXXON HOUSTON	23	56
EXXON JAMESTOWN	2	18
EXXON LEXINGTON	8	12
EXXON LONG BEACH	33	59
EXXON NEW ORLEANS	18	20
EXXON NORTH SLOPE	26	40
EXXON PHILADELPHIA	44	46
EXXON PRINCETON	29	19
EXXON SAN FRANCISCO	5	5
EXXON VALDEZ	49	56
EXXON YORKTOWN	3	22
FAIRWIND	1	
FALCON LEADER	22	
FALSTRIA	58	126
FEDERAL SEAWAY	14	22
FERNAO LOPES	2	10
FERNCROFT	106	195
FETISH	12	139
FIGARO	4	22
FIRST LT JACK LUMMUS	3	
FLORIDA RAINBOW	6	
FORTALEZA	54	131
FRANCIS SINCERE NO. 6	20	19
FRED R WHITE JR		55
FREDERICKSBURG	44	100
FREMO SIRIUS	49	128
FROTASIRIUS	13	42
GALVESTON	4	7
GEAR GARLAND	43	73
GEMINI	62	171
GENERAL ROXAS	12	15
GENEVIEVE LYKES	11	39
GEORGE A. SLOAN	112	155
GEORGE A. STINSON		158
GEORGE H. WEYERHAEUSER	15	16
GEORGE WASHINGTON BRID	176	13
GERONIMO		29
GLACIER BAY	20	87
GLOBAL FRONTIER	78	165
GLOBAL PIONEER	44	39
GLORIA	13	59
GLORIOUS SPICA	62	
GLORY SPIRIT	30	
GOLDEN APO	31	11
GOLDEN BLISS	20	
GOLDEN GATE BRIDGE	154	72
GOLDEN HAWK	47	59
GRACE ISLAND	6	
GREAT LAND	187	84
GREEN ANGELES	30	66
GREEN BAY	61	117
GREEN HARBOUR	16	
GREEN ISLAND	33	73
GREEN LAKE	14	77
GREEN MASTER	62	58
GREEN MAYA	58	49
GREEN RAINIER	16	
GREEN SAIKAI	15	15
GREEN SASEBO	30	8
GREEN STAR	31	41
GREEN VALLEY	39	
GREEN WAVE	34	45
GREEN WOOD	2	20
GUAICURI	59	
GULF IDEAL	27	
GYPSUM COUNTESS	161	
GYPSUM KING	223	
H.J. HAYNES		160
HAI JUNG	26	
HAKUSAN	88	55
HANJIN BUSAN	1	30
HANJIN CHEJU	2	
HANJIN HONG KONG	29	12
HANJIN KEELUNG	1	
HANJIN KOBE	24	34
HANJIN LONG BEACH	9	14
HANJIN POHANG	18	7
HANJIN SAVANNAH	15	12
HASSAN MERCHANT	64	52
HEERENGRASHT	57	
HENRY FORD II		70
HERBERT C. JACKSON	18	
HERMENIA		65
HIYOSHI MARU	50	
HOEGH CAIRN	12	
HOEGH CLIPPER	6	6
HOEGH DENE	2	56
HOEGH DRAKE	22	56
HOEGH DUKE	93	
HOEGH DYKE	12	70
HOEGH MASCOT	11	72
HOEGH MINERVA	21	
HOHSING BREEZE	22	56
HOLIDAY	34	202
HOLSTEN TRADER	57	78
HOMERIC	23	44
HONOLULU	77	
HRELJIN	21	
HUMBER ARM	40	119
HYUGA MARU	83	
HYUNDAI # 105		16
HYUNDAI #1	1	
HYUNDAI #101	9	25
HYUNDAI #108	38	78
HYUNDAI #18	6	
HYUNDAI CHALLENGER	21	79
HYUNDAI EXPLORER	14	51
HYUNDAI INNOVATOR		13
HYUNDAI PIONEER		32
IBIS ARROW	84	102
IMPERIAL		5
INDONESIA VICTORY	1	
INGER	22	76
IRVING MIAMI	16	
ISLA BARTOLOME	1	
ISLAND PRINCESS	114	
ISOLDE	32	
ITALICA	22	106
J.A.W. IGLEHART		170
J.L. MAUTHE	25	43
J.T. HIGGINS		166
JADRAN	1	
JALISCO	83	65
JAMES LYKES	23	59
JAMES R. BARKER		204
JAPAN APOLLO	141	134
JEAN LYKES	26	38
JOHN A. MCCONE		44
JOHN G. MUNSON	153	217
JOHN LYKES	3	31
JOSEPH L. BLOCK		185
JOSEPH LYKES	10	
JOVIAN LILY	58	158
JOVIAN LUZON	18	
JUBILEE	41	62
JULIUS HAMMER	3	88
KALAYAAN	134	
KALIDAS	36	69
KAMNIK	1	
KASINA	32	37
KASTURBA	7	7
KAUAI	38	153
KEE LUNG	26	23
KEISHO MARU	71	185
KENAI	11	42
KENNETH E. HILL	49	163
KENNETH T. DERR	2	
KENT	51	53
KEYSTONE CANYON	11	57
KEYSTONER	34	90
KITTANNING	18	
KNORR	6	9
KOFUKU MARU	16	9
KOLN EXPRESS	67	
KOREAN JACEWON	29	21
KOREAN WONIS JIN	29	
KOREAN WONIS ONE	35	56
KOREAN WONIS SEVEN	24	48
KOREAN WONIS SUN	7	25
LA PAMPA	33	
LANETTE	1	
LARS MAERSK	28	65
LAURA MAERSK	41	112
LAWRENCE A. GIANELLA	75	46
LEDA MAERSK	35	34
LEISE MAERSK	24	22
LERMA	112	
LESLIE LYKES	43	65
LETITIA LYKES	34	64
LEWIS WILSON FOY		365
LEXA MAERSK	23	29
LIBERTADOR GRAL SAN MA	1	
LICA MAERSK	63	78
LILLOOET	53	90
LING LEO	14	116
LIONS GATE BRIDGE	43	124
LIRCAY	6	18
LLOYD ALTAMIRAP	1	
LLOYD SAO PAULO	88	
LLOYD SERGIPA	4	6
LLOYD VITORIA	39	44
LNG TAURUS	4	175
LONG BEACH	6	48
LOTUS ACE	106	
LOUIS MAERSK	30	101
LOUISE LYKES	57	127
LOUISIANA BRIMSTONE	6	21
LPG HARDANGER		59
LT. ODYSSEY	6	
LURLINE	46	196
LUZON	23	109

Ship Name	radio	mail
M. P. GRACE	69	
M/V MARINE RELIANCE	47	86
MADAME BUTTERFLY	41	
MAERSK TACOMA	90	37
MAERSK WAVE	29	209
MAERSK WIND	32	44
MAJ SANDVED	59	51
MAJ STEPHEN W PLESS MP	12	11
MALLORY LYKES	4	10
MAMMOTH FIR	1	
MANGAL DESAI	9	
MANUKAI	70	187
MANULANI	27	154
MARATHA MARINER	14	1
MARATHA MELODY	3	
MARATHA SHOGUN	42	6
MARGARET LYKES	79	174
MARGARITA	40	194
MARIA TOPIC	10	
MARIF	21	16
MARITIME NOBLE	176	
MARJORIE LYKES	16	41
MARLIN	39	205
MASON LYKES	31	40
MATSONIA	40	161
MAUI	54	182
MAUNALEI	19	146
MC KINNEY MAERSK	35	51
MEDALLION	107	196
MEDUSA CHALLENGER	62	165
MEGA HILL	22	
MEGHANA	6	
MELBOURNE HIGHWAY	1	
MELVILLE	110	110
MENINA BARBARA	45	91
MERAK EIGHTY	17	13
MERIDA	7	112
MESABI MINER		96
MICRONESIAN COMMERCE		21
MICRONESIAN INDEPENDEN	175	112
MIDDLETOWN	135	187
MILTA	5	
MING PEACE		43
MING PLEASURE	11	
MING PROMOTION	33	24
MING PROPITIOUS	28	22
MING SPRING	7	
MING STAR		10
MING SUN	5	35
MOANA PACIFIC	211	282
MOBIL ARCTIC	30	202
MOBIL MERIDIAN	171	176
MOKU PAHU	102	148
MORANT	1	
MORMACSKY	19	
MORMACSTAR	12	63
MORMACSUN	1	4
MOSEL EXPRESS	144	
MOUNT FUJI	14	
MOUNT WASHINGTON	1	
MT. ELIANE	8	29
MYRON C. TAYLOR	57	79
NACIONAL SANTOS	8	8
NANCY LYKES	3	43
NATIONAL DIGNITY	32	165
NATIONAL HONOR	15	81
NATIONAL PRIDE	21	103
NAVIGATOR		106
NAVIOS ENTERPRISE	27	
NECHES	5	
NEDLLOYD ELBE	108	
NEDLLOYD KATWIJK	89	
NEDLLOYD KEMBLA	56	
NEDLLOYD KINGSTON	92	
NEDLLOYD KYOTO	80	
NEDLLOYD ROCHESTER	105	
NEDLLOYD ROSARIO	69	
NEDLLOYD ROTTERDAM	95	
NEDLLOYD ROUEN	107	
NEPTUNE ACE	36	
NEPTUNE AMBER	89	140
NEPTUNE CORAL	150	225
NEPTUNE DIAMOND	197	
NEPTUNE GARNET	69	
NEPTUNE IVORY	95	
NEPTUNE KIKU	5	
NEPTUNE PEARL	82	194
NEPTUNE TOURMALINE	7	
NEW GLORY	33	126
NEW HORIZON		188
NEW INDEPENDENCE	53	154
NEW JERSEY MARU	121	
NEW YORK MARU	101	
NISSAN LAUREL	19	
NISSAN MARU	95	
NOAA DAVID STARR JORDA	195	223
NOAA SHIP ALBATROSS IV	206	225
NOAA SHIP CHAPMAN	102	123
NOAA SHIP DAVIDSON	162	199
NOAA SHIP DELAWARE II	264	246
NOAA SHIP DISCOVERER O	2	
NOAA SHIP FERREL	137	86
NOAA SHIP HECK 591	65	137
NOAA SHIP JOHN N COBB	19	
NOAA SHIP MCARTHUR	391	502
NOAA SHIP MILLER FREEM	202	
NOAA SHIP MT MITCHEL	37	
NOAA SHIP OCEANOGRAPHE	209	270
NOAA SHIP OREGON II	247	307
NOAA SHIP RAINIER	128	135
NOAA SHIP RESEARCHER	261	299
NOAA SHIP RUDE 590	21	27
NOAA SHIP SURVEYOR	79	
NOAA SHIP T. CROMWELL	219	239
NOAA SHIP WHITING	196	226
NORDHVAL	138	
NORWAY	26	39
NOSAC EXPRESS	50	95
NOSAC SEL	87	277
NOSAC SKAUKAR	69	138
NOSAC SKY	14	51
NOSAC STAR	15	12
NOSAC TAKARA	44	65
NOSAC TAKAYAMA	115	249
NOSAC TRIGGER	33	103
NOSIRA SHARON	77	32
NURNBERG EXPRESS	60	
OAK GLORY	18	66
OAKLAND	49	92
OBERON	11	
OCEAN BRIDGE	6	
OCEAN CHEER	2	
OCEAN COMMANDER #1	40	14
OCEAN LEGEND	8	
OCEAN REX		73
OCEAN STEELHEAD	12	192
OLEANDER	117	92
OLGA TOPIC	13	10
OMI CHAMPION	36	137
OMI CHARGER		27
OMI WILLAMETTE	2	
ORAGONJA	6	86
ORANGE BLOSSOM	67	162
ORANGE STAR		164
ORCHID	47	64
ORCHID #2	15	78
OREGON RAINBOW	35	171
ORIENTAL DIPLOMAT	4	10
ORIENTAL EDUCATOR	164	268
ORIENTAL EXECUTIVE	62	251
ORIENTAL EXPLORER	88	51
ORIENTAL FAIR	97	163
ORIENTAL FAITH	27	49
ORIENTAL FORTUNE	37	
ORIENTAL FRIENDSHIP	86	
ORIENTAL KNIGHT	13	
ORIENTAL MINISTER	2	4
ORIENTAL PATRIOT	30	189
ORIENTAL PHOENIX		309
ORIENTAL SOVEREIGN	2	
ORIENTAL TAIO	3	6
ORION HIGHWAY	30	
ORLY	30	98
OVERSEAS ALICE	40	72
OVERSEAS CHICAGO	42	62
OVERSEAS HARRIET	50	71
OVERSEAS JUNEAU	32	41
OVERSEAS MARILYN	70	113
OVERSEAS NATALIE		60
OVERSEAS NEW YORK	3	117
OVERSEAS OHIO	4	52
OVERSEAS VIVIAN	28	
OVERSEAS WASHINGTON	4	58
PACBARON	22	
PACDUCHESS	6	
PACDUKE	14	
PACEMPEROR	32	
PACGLORY	28	
PACIFIC ANGEL	28	14
PACIFIC ARROW	121	76
PACIFIC CLIPPER	26	8
PACIFIC DAWN	27	113
PACIFIC ENTREPRENEUR	2	4
PACIFIC HIGHWAY	89	6
PACIFIC PRINCESS	92	
PACIFIC PROGRESS	1	
PACIFIC RAINBOW	31	125
PACIFIC VENTURE	14	
PACIFIC VICTORY	20	25
PACIFIC WING	52	
PACKING	99	
PACMAJESTY	20	27
PACMONARCH	4	
PACNOBLE	3	
PACPRINCESS	22	
PALM ACE	36	23
PANAMA	1	21
PANCALDO	6	
PATRIOT	18	16
PAUL BUCK	58	91
PAUL H. TOWNSEND		56
PAUL THAYER		79
PAWNEE	49	67
PECOS	24	66
PEGGY DOW	87	
PENNSYLANIA RAINBOW	11	59
PENNSYLVANIA TRADER	20	46
PETERSBURG	8	
PETERSFIELD	92	
PFC EUGENE A. OBREGON	30	57
PFC JAMES ANDERSON JR	6	16
PFC WILLIAM B. BAUGH	37	117
PHILADELPHIA	15	73
PHILIP R. CLARKE	143	191
PHILIPPINE VICTORY	11	
PILAR	15	23
POLAR ALASKA	10	195
PONCE	201	304
POTOMAC TRADER	35	78
PRESIDENT ADAMS	4	60
PRESIDENT ARTHUR	80	270
PRESIDENT BUCHANAN	66	200
PRESIDENT CLEVELAND	19	
PRESIDENT EISENHOWER	140	145
PRESIDENT F. ROOSEVELT	82	172
PRESIDENT GARFIELD	90	263
PRESIDENT GRANT	52	141
PRESIDENT HARDING	84	232
PRESIDENT HARRISON	106	179
PRESIDENT HOOVER	61	177
PRESIDENT JACKSON	48	81

Ship Name	radio	mail
PRESIDENT JEFFERSON	60	141
PRESIDENT JOHNSON	79	214
PRESIDENT KENNEDY	36	44
PRESIDENT LINCOLN	120	210
PRESIDENT MADISON	8	144
PRESIDENT MONROE	115	212
PRESIDENT PIERCE	36	37
PRESIDENT TAYLOR	15	21
PRESIDENT TYLER	118	263
PRESIDENT VAN BUREN	29	56
PRESIDENT WASHINGTON	162	231
PRESQUE ISLE		341
PRIDE OF TEXAS	29	28
PRIMORJE	26	
PRINCE OF TOKYO	83	205
PRINCE WILLIAM SOUND	14	41
PRINCESS DIAN	57	137
PROSPERIDAD	24	84
PVT HARRY FISHER	24	
QUEEN ELIZABETH 2	55	
QUEEN OPAL	60	41
RAINBOW BRIDGE	63	27
RAINBOW HOPE	102	166
RED ARROW	12	
REGENT	10	32
REGINA MAERSK	29	107
RESERVE	103	259
RICHARD G MATTIESEN	150	42
RICHARD REISS	19	25
RIMBA SEPETIR	12	
RIO ESQUEL	40	58
RIO FRIO	42	
RIO LIMAY	41	6
ROBERT CONRAD	120	
ROBERT E. LEE	16	35
RODIN	150	
ROGER BLOUGH		163
ROGER R. SIMONS	12	29
ROSARIO DEL MAR	5	
ROSINA TOPIC	25	39
ROSTAND	77	
ROTTERDAM	98	
ROYAL PRINCESS	70	
RUTH LYKES	38	94
S.T. CRAPO		196
SAM HOUSTON	4	31
SAM LAUD		89
SAMOAN REEFER	50	95
SAMU	13	168
SAMUEL H. ARMACOST	8	
SAN JUAN	54	177
SAN MATEO VICTORY	21	72
SANKO DIGNITY	19	
SANKO EAGLE	3	
SANKO HAWK	3	
SANKO LAPIS	75	33
SANKO LILY	11	
SANKO MOON	2	
SANKO PEACE	26	
SANKO ROBIN	7	
SANKO VENUS	1	
SANSINENA II	30	110
SANTA ADELA	26	149
SANTA CRUZ II	47	
SANTA JUANA	88	184
SATSUNA MARU	8	
SAUDI DIRIYAH	5	
SAVANNAH	104	
SAVONITA	1	
SCANDINAVIAN HIGHWAY	141	
SEA BELLS	6	65
SEA DIAMOND	59	120
SEA FAN	44	128
SEA FORTUNE	40	24
SEA FOX	41	37
SEA JADE	38	115
SEA LANTERN	47	134
SEA LIGHT	25	89
SEA LION	56	57
SEA QUEEN	1	
SEA TRANSPORTER	100	
SEA WOLF	4	122
SEALAND ADVENTURER	39	134
SEALAND ANCHORAGE	27	88
SEALAND CONSUMER	60	179
SEALAND DEFENDER	101	208
SEALAND ECONOMY	47	133
SEALAND ENDURANCE	44	162
SEALAND ENTERPRISE	11	40
SEALAND EXPLORER	54	148
SEALAND EXPRESS	29	140
SEALAND FREEDOM	54	208
SEALAND INDEPENDENCE	61	42
SEALAND INNOVATOR	44	117
SEALAND KODIAK	1	5
SEALAND LEADER	21	133
SEALAND LIBERATOR	45	173
SEALAND MARINER	46	188
SEALAND MARKETER	63	245
SEALAND NAVIGATOR	24	59
SEALAND PACER	23	135
SEALAND PACIFIC	3	20
SEALAND PATRIOT	42	135
SEALAND PIONEER	25	122
SEALAND PRODUCER	30	107
SEALAND TACOMA	17	37
SEALAND TRADER	22	44
SEALAND VENTURE	53	191
SEALAND VOYAGER	139	232
SEAWARD BAY	9	
SEDCO/BP 471	80	170
SEVEN OCEAN	58	39
SGT WILLIAM A BUTTON		1
SGT. METEJ KOCAK	30	
SHELDON LYKES	94	97
SHELLY BAY	15	
SHENAHON	24	30
SHIN BEISHU MARU	51	
SHINKASHU MARU	52	
SHIRLEY LYKES	16	61
SILVER CLIPPER	17	
SILVER STAR	18	
SINGAPORE VICTORY		53
SKANDERBURG	1	
SKAUBORO	50	107
SKAUGRAN	61	103
SKOUBORD	44	96
SKRIM	163	
SOARER DIANA	9	
SOLON TURMAN	32	53
SONBAI	35	104
SONG OF NORWAY	17	62
SOPHIA	69	
SOUTHLAND STAR	153	
SPRING BEAR	113	
SPRING BIRD	3	26
SPRING CONDOR	17	33
SPRING SEAGULL		13
SPRING SWIFT		18
SPRING VEGA	11	
STAR EAGLE	45	70
STAR ESPERANZA	29	138
STAR GEIRANGER		1
STAR GRAN	3	99
STAR HONGKONG	97	
STAR MIRANDA		7
STAR OF TEXAS	74	
STARWARD	4	
STELLA LYKES	11	33
STEWART J. CORT		211
STONEWALL JACKSON	23	26
STREAM BALABAC	112	
STRIDER ISIS	12	
STUTTGART EXPRESS	52	
SUE LYKES	25	65
SUGAR ISLANDER		64
SUN PACIFIC #2	6	24
SUN PRINCESS	90	
SUN VIKING	33	41
SUNBELT DIXIE	73	122
SUNORA	14	
SYOSSET	2	
TABASCO	47	61
TAI CORN	17	32
TARGET	64	133
TEXACO CALIFORNIA	8	35
TEXACO CONNECTICUT	3	
TEXACO FLORIDA	19	24
TEXACO GEORGIA		33
TEXACO MASSACHUSETTS	35	49
TEXACO RHODE ISLAND	1	
TFL DEMOCRACY	13	91
TFL ENTERPRISE	6	75
TFL FREEDOM	7	120
TFL INDEPENDENCE	10	61
TFL JEFFERSON	5	73
TFL LIBERTY	29	95
THOMAS G. THOMPSON	95	22
THOMAS WASHINGTON	47	155
THOMPSON LYKES	21	78
THOMPSON PASS	5	45
TOHBEI MARU	120	39
TOKYO MARU	90	
TOKYO RAINBOW	38	19
TONCI TOPIC	26	38
TONIC VENTURE	1	
TONSONIA	87	190
TOWER BRIDGE	76	
TRAVE ORE	30	19
TRITON		48
TROPIC SUN	14	
TROPICAL BEAUTY	18	44
TROPICALE	53	91
TULSIDAS	50	74
TUNISIAN REEFER	1	
ULTRAMAR	47	90
ULTRASEA	30	82
UNITED HOPE	113	102
UNITED SPIRIT	33	51
UNIVERSE	1	
USCGC ACACIA (WLB406)	19	
USCGC ALERT (WMEC 630)	15	60
USCGC BASSWOOD (WLB 38	54	68
USCGC BEAR (WEMC 901)	6	
USCGC BISCAYNE BAY	7	16
USCGC BLACKHAW (WLB 39	4	
USCGC BOUTWELL WHEC 71		6
USCGC BUTTONWOOD WLB 3	26	
USCGC CHEROKEE WMEC 16	18	115
USCGC CHILULA (WMEC 15	1	
USCGC CITRUS (WMEC 300	12	113
USCGC CLOVER (WMEC 292	41	
USCGC COURAGEOUS	16	
USCGC DAUNTLESS WMEC 6	1	
USCGC DECISIVE WMEC 62	1	
USCGC DEPENDABLE	5	
USCGC EAGLE (WIX 327)	107	
USCGC INGHAM (WHEC 35)	1	
USCGC IRONWOOD (WLB 29	40	
USCGC JARVIS (WHEC 725	70	50
USCGC KATMAI BAY	14	27
USCGC LIPAN (WMEC 85)	3	
USCGC MACKINAW	54	155
USCGC MALLOW (WLB 396)	2	
USCGC MESQUITE (WLB 30	18	18
USCGC MIDGETT (WHEC 72	66	162
USCGC MORGENTHAU	104	91
USCGC NEAH BAY	5	7
USCGC NORTHLAND WMEC 9	26	
USCGC NORTHWIND WAGB 2	6	7
USCGC PLANETREE	20	

Ship Name	radio	mail
USCGC POLAR SEA WAGB 1	12	
USCGC POLAR STAR WAGB	228	
USCGC RESOLUTE WMEC 62	42	
USCGC RUSH (WHEC 723)	2	117
USCGC SEDGE (WLB 402)	22	
USCGC STEADFAST WMEC 6	29	
USCGC SUNDEW (WLB 404)	8	
USCGC SWEETBRIER WLB 4	10	18
USCGC TAMAROA (WMEC 16	2	
USCGC TAMPA WMEC 902	66	93
USCGC VALIANT (WMEC 62	33	34
USCGC VIGILANT WMEC 61	65	121
USCGC WESTWIND WAGB 28	44	14
USCGC WOODRUSH (WLB 40	14	
USCGC YOCONA (WMEC 168	20	28
USNS ALTAIR	1	
USNS APACHE (T-ATF 172	6	21
USNS BARTLETT(T-AGOR 1	44	79
USNS CAPELLA	35	75
USNS CATAWABA		114
USNS CHAUVENET	86	
USNS DE STEIGUER	2	
USNS DENEBOLA	10	
USNS GUS W. DARNELL	46	3
USNS JOHN LENTHAL		36
USNS MERCURY	38	66
USNS MISSISSINEWA		155
USNS MOHAWK (T-ATF 170	37	57
USNS NARRAGANSETT	12	26
USNS NEOSHO (T-AO 143)		86
USNS PASSUMPSIC TAO 10		30
USNS PAWCATUCK TAO-108		125
USNS POLLUX	16	56
USNS POWHATAN TATF 166	36	46
USNS RANGE SENTINEL		11
USNS REDSTONE	1	67
USNS SATURN T-AFS-10		89
USNS SEALIFT ANTARCTIC	40	137
USNS SEALIFT ARCTIC	21	103
USNS SEALIFT ATLANTIC	4	13
USNS SEALIFT CARIBBEAN	4	8
USNS SEALIFT CHINA SEA	28	62
USNS SEALIFT IND'N OCE	21	31
USNS SEALIFT MED	1	
USNS SEALIFT PACIFIC	52	
USNS SILAS BENT T-AGS	24	77
USNS SIRIUS (T-AFS 8)		56
USNS SPICA (T-AFS 9)		154
USNS STALWART T-AGOS-1		40
USNS TRUCKEE (T-AO 147		30
USNS VANGUARD TAG 194	57	148
USNS WACCAMAW(TAO-109)		72
VAN TRADER	36	77
VERRAZANO BRIDGE	71	
VICTORY ACE	28	42
VISHVA PANKAJ	1	
VISHVA PAROG	4	
VISHVA PRAFULLA	21	84
VISHVA SHAKTI	6	
VISHVA SIDDHI	16	
WASHINGTON HIGHWAY	107	18
WASHINGTON RAINBOW #2	63	108
WECOMA		61
WELLINGTON STAR	165	
WESER EXPRESS	26	
WESTERN HIGHWAY	54	
WESTOCEAN	288	
WESTWARD		34
WESTWARD VENTURE	43	56
WESTWOOD ANNETTE	16	88
WESTWOOD BELINDA		15
WESTWOOD JAGO	140	2
WESTWOOD MARIANNE	33	84
WESTWOOD MERCHANT		53
WESTWOOD MERIT	24	101
WESTWOOD MUSKETEER	1	
WILFRED SYKES	147	332
WILLIAM J. DELANCEY		380
WILLIAM R. ROESCH		156
WILLOWBANK	103	
WINTER STAR	25	83
WINTER SUN	26	44
WORLD WING #2	144	
YAMASHIN MARU	140	62
YOUNG SCOPE	70	
YOUNG SOLDIER	46	107
YOUNG SPORTSMAN	27	48
YOUNG SPROUT	66	62
YS ARGOSY	23	33
ZAPATA ARCTIC	175	
ZAPATA COURIER	45	
ZEELANDIA	17	
ZEYNEP-K	6	21
ZIM GENOVA	14	
ZIM HAIFA	47	
ZIM HONGKONG	41	
ZIM HOUSTON	21	
ZIM IBERIA	38	
ZIM KEELUNG	27	
ZIM LIVORNO	1	
ZIM MARSEILLES	38	
ZIM MIAMI	9	
ZIM NEW YORK	36	
ZIM SAVANNAH	65	
ZIM TOKYO	38	
ZOELLA LYKES	13	23
3ELB3	26	52
3EQM3		29
3FVU2	1	
5LTW	53	
6YSJ	4	27
7KBW	124	85
9VJK	15	
9VNU	15	
A8CY	5	
AQOL		34
BKHB	11	6
D5DE	1	
D5SO	5	
DVJC	11	114
DZJG	1	
DZSZ		23
ELAV6	3	
ELCF4	5	
ELCM3	10	
ELCP	1	
ELDV3	5	
ELEM	19	
ELPW	1	
GXES	84	
H3YS	1	
HOMH	11	18
JREL	119	
KGBK		114
KGDJ	1	
KHLZ		19
KHRH	33	204
KLPN	15	
KNJA	3	21
KRBS	26	189
KTSQ	1	
NOYK	41	84
NRVC		79
ONAQ	10	
OXZH	14	98
OYIT	6	47
OYKZ	17	66
PJCO	47	
S6CD	2	
S6EP	77	
S6FC	1	
TCCH	6	
VGLN	65	
VRGF	40	
VTPM		84
WETZ		73
WFJK	69	162
WHSJ	1	
WIAG	48	127
WNRG		53
WOVS	46	153
WSNJ		27
WSVE		15
WXQ7334		56
WZJC	99	274
WZJD	74	127
WZJF	57	244
WZR7718		30
YCTD	10	
YCTE	1	

SUMMARY: GRAND TOTAL VIA RADIO 41914

GRAND TOTAL VIA MAIL 64967

TOTAL UNIQUE OBS 82694

TOTAL DUPLICATES 24187 (29.2%)

UNIQUE RADIO OBS.17727 (21.4%)

UNIQUE MAIL OBS. 40780 (49.3%)

Top Ship Radio and Mail: NOAA Ship McArthur

Bathy-Tesac Data Received at NMC

October, November and December 1987

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
A8VI	1	1	0	PACDUCHESS
A8YI	5	5	0	PACBARON
BNTB	42	42	0	***
BNTR	6	6	0	***
CBAK	35	35	0	ANAKENA
CGBV	202	0	202	DAWSON
CGDG	127	69	58	HUDSON
CGDV	169	169	0	W. TEMPLEMAN
CG2683	47	47	0	ALFRED NEEDLER
CG2958	7	7	0	TULLY
CG2959	7	7	0	L.J. COWLEY
CG2965	2	2	0	RICKER
CSBL	4	4	0	DAMIAO DE GOIS
CS2	32	32	0	CANSHIP2
C6CV9	38	38	0	LILLOOET
C7C	260	0	260	OCEAN STATION CHARLIE
C7L	105	105	0	OCEAN STATION LIMA
DBBH	124	124	0	METEOR
DBFP	97	97	0	WALTHER HERWIG
DBLK	55	55	0	POLARSTERN
DCH	6	6	0	ELBE 1
DCL	10	0	10	FEHMARNBELT-FEUERSCHIFF
DEOF	43	43	0	***
DGFR	50	50	0	MONTE OLIVIA
DGLM	43	43	0	MONTE ROSA
DGSR	54	54	0	MONTE SARMIENTO
DGVK	106	106	0	COLUMBIA VICTORIA
DGZV	52	52	0	COLUMBUS VIRGINIA
DHCW	41	41	0	COLUMBUS WELLINGTON
DHJW	78	78	0	***
DHOU	16	16	0	***
DLEZ	7	7	0	YANKEE CLIPPER
DZLI	9	9	0	***
D5BC	12	12	0	SEDCO/BP471
D5ND	37	37	0	SAINT LUCIA
D5NE	36	36	0	MT. CABRITE
D5NZ	91	91	0	POLYNESIA
ELDM8	91	91	0	SEAL ISLAND
ELDW8	68	68	0	SKRIM
ELED8	23	23	0	PACPRINCESS
EREA	134	95	39	MONSOON
EREB	144	107	37	VOLNA
EREC	31	0	31	PRYLYV
EREH	31	0	31	PRIBOI
EREI	143	9	134	OCEAN
ERES	5	5	0	VICTOR BUGAEN
ERET	95	94	1	GEORGE OUSHAKOV
EREU	126	125	1	ERNST KRENKEL
ESGG	117	9	108	FROLOV VYACHESLAV
EWAU	1	1	0	***
FAUB	3	3	0	***
FBSE	2	2	0	CHARNER
FFNO	1	1	0	***
FNBF	54	54	0	ROSTAND
FNCW	77	77	0	ROUSSEAU
FNDZ	22	22	0	ZELANDE
FNGB	27	27	0	MARION DUFRESNE
FNGS	114	114	0	LAFAYETTE
FNOM	43	43	0	ANGO
FNPA	33	33	0	RONSARD
FNQB	31	31	0	***
FNQC	7	7	0	***
FNXE	84	84	0	RODIN
GACA	19	19	0	***
GOVL	9	9	0	ACT 4
GPHH	6	6	0	FARNELLA
GXRH	19	19	0	***
GXYY	28	28	0	***
GYRW	38	38	0	ENCOUNTER BAY
HCGT	7	7	0	BUCCANEER
HPAN	1	1	0	MICRONESIAN COMMERCE
HPEW	37	37	0	PACIFIC ISLANDER
H8DY	115	115	0	CAP ANAMUR
H9BQ	63	63	0	MICRONESIAN INDEPENDENCE
JASQ	31	31	0	HIYOSHI MARU
JAWD	31	31	0	AMBASSADOR BRIDGE
JBES	69	69	0	YAMASHIN MARU
JBOA	36	36	0	KEIFU MARU
JBRR	24	24	0	JAPAN TUNA 2
JCDT	43	43	0	AMERICA MARU
JCIN	16	16	0	TOKYO MARU
JCOD	78	78	0	SHOYU
JDRD	5	5	0	SHOYU MARU
JFDG	84	84	0	SHUMPU MARU
JGDW	17	17	0	KEITEN MARU
JGZK	106	106	0	RYOFU MARU
JHAB	56	56	0	BOUSEI MARU
JIOW	41	41	0	ALASKA MARU
JJZC	23	23	0	HAKONE MARU
JLVC	1	1	0	***
JPJK	27	27	0	***
JPJX	35	35	0	HAKURYU MARU
JPVB	56	56	0	SEIFU MARU
JSVY	13	13	0	SHIRASE
KDBG	17	17	0	PRESIDENT LINCOLN
KEOC	53	53	0	EDGAR M. QUEENY
KGWT	22	22	0	THOMPSON, T.G.
KGWU	145	145	0	WASHINGTON, T.
KIYO	18	18	0	EXXON JAMESTOWN
KNBD	14	14	0	DELAWARE II
LOPD	4	4	0	***
LZTI	23	23	0	***
NAQD	97	97	0	JARVIS
NBTM	82	82	0	CGC POLAR STAR
NDWA	49	49	0	MORGENTHAU
NENC	41	41	0	USNS SEALIFT PACIFIC
NHTE	17	17	0	ELROD
NHWR	68	68	0	MIDGETT
NIKA	40	40	0	SEALIFT ATLANTIC
NIKL	51	51	0	TAMPA
NLGF	2	2	0	NORTHLAND
NLVS	85	85	0	RUSH
NQST	48	48	0	SEALIFT ARCTIC
NRCB	67	67	0	EAGLE

Bathy–tesac Data Received at NMC cont'd

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
NRUO	59	59	0	POLAR SEA
NYCQ	11	11	0	CGC BOUTWELL
NYKN	1	1	0	***
NZSR	11	11	0	***
OWEQ	39	39	0	MC KINNEY MAERSK
OXFB	53	53	0	LEXA MAERSK
OXMD	33	33	0	LARS MAERSK
OXYL	20	20	0	BAMSA DAN
OYBG	3	3	0	FALSTRIA
PACM	14	14	0	PACIFIC MISSILE RANGE
PGDF	40	40	0	NEDLLOYD KATWIJK
PGDG	27	27	0	NEDLLOYD KINGSTON
PGDS	39	39	0	NEDLLOYD KYOTO
PGOF	46	46	0	NEDLLOYD KEMBLA
PJYG	73	73	0	OLEANDER
PLAT	149	149	0	PLATFORM
SCOV	1	1	0	TV 244
SCPE	2	2	0	TV 253
SCPH	4	4	0	***
SCPI	3	3	0	***
SCPK	1	1	0	TV 260
SCQG	1	1	0	TV 245
SEPI	14	0	14	***
SEXN	5	5	0	TV 227
SEXQ	3	3	0	TV 278
SGQJ	77	77	0	ELGAREN
SHIP	727	721	6	NO SHIP CALL SIGN REC'D
SHPF	3	3	0	TV 281
SJIB	1	1	0	TV 282
SJTR	4	4	0	TV 271
SKVP	11	11	0	***
SKVQ	1	1	0	***
SMZJ	2	2	0	TV 105
SMZQ	3	3	0	TV 102
TFJA	25	25	0	ARNI FRIDRIKSSON
TFXQ	14	14	0	RAKKAFOSS
UBNZ	91	81	10	SHULEYKIN AKADEMIK
UFYN	83	3	80	***
UJFO	89	87	2	MULTANOVSKIY PROF
UJOB	1	1	0	***
UMAY	186	5	181	ACADEMIC SHIRSHOV
UMFW	57	57	0	PROF. ZUBOV
UPUI	61	61	0	PROFESSOR VIZE
UQHM	29	2	27	***
UQYC	38	38	0	***
URYK	2	2	0	***
URYM	30	0	30	RUDOLF SAMOILOVICH
USWN	39	0	39	***
UTSZ	117	0	117	***
UUPB	63	7	56	AKADEMIK N. SHOKALSKIY
UUQR	8	8	0	MOLOHANOV PAVEL PRO
UVMJ	4	4	0	VSEVOLOD BERYOZKIN
UVMM	158	125	33	YAKOV GAKKEL
UZGH	42	40	2	PASSAT
VCBT	70	70	0	CAPE ROGER
VCLG	53	53	0	***
VCTF	24	24	0	CAPE BRIER
VC945	15	15	0	GADUS ATLANTICA
VJBQ	45	45	0	ANRO AUSTRALIA
VJZK	1	1	0	SWAN
VKCK	49	49	0	STUART
VKCN	31	31	0	CANBERRA
VKCV	48	48	0	DERWENT
VKDA	17	17	0	***
VKLA	35	35	0	ADELAIDE
VKLC	5	5	0	BRISBANE
VKMK	51	51	0	***
VKMN	14	14	0	TEALE
VKMS	99	99	0	COOK
VLNB	50	50	0	TORRENS
VMAP	177	177	0	AUSTRALIAN PROGRESS
VPGE	69	69	0	***
VP56	189	189	0	AIRCRAFT
VXN8	111	111	0	AIRCRAFT
WCGN	39	39	0	CHEVRON CALIFORNIA
WDAG	21	21	0	SHENAHON
WECB	186	186	0	MELVILLE
WHBA	38	38	0	R.D.CONRAD
WMVF	82	82	0	ALBATROSS IV
WRB2237	24	24	0	BARARA H.
WSC22	12	12	0	POINT SUR
WTDF	12	12	0	T. CROMWELL
WTDK	288	288	0	C.S. JORDAN
WTDM	74	74	0	M.FREEMAN
WTDO	83	51	32	OREGON II
WTEB	1	1	0	FAIRWEATHER
WTED	5	5	0	CHAPMAN
WTEF	27	27	0	RAINIER
WTEG	1	1	0	MOUNT MITCHEL
WTEJ	260	260	0	MC ARTHUR
WTEK	11	11	0	DAVIDSON
WTEP	122	122	0	OCEANOGRAPHER
WTER	266	266	0	RESEARCHER
WTES	9	9	0	SURVEYOR
WTEW	2	2	0	WHITING
WTEZ	40	40	0	FERREL
WXBR	13	13	0	CHEVRON MISSISSIPPI
WXQ7334	14	14	0	PETER ANDERSON
WX829	18	18	0	FRED MOORE
WYR44	108	108	0	W. J.BELANCEY
WYR7512	27	27	0	BALD EAGLE
WYR9891	12	12	0	SEA HAVEN
WYV6568	72	72	0	DEFIENCE
WZE3929	56	56	0	MOANA WAVE
Y3CH	10	0	10	PROF. ALBRECHT PENCK
ZCSK	37	37	0	***
ZCSL	57	57	0	NIMOS
ZCUZ	1	1	0	POYANG
3EIX2	3	3	0	PRESENTE IBA
3FHI2	100	100	0	MOANA PACIFIC
7JFP	48	48	0	DAI 48 SUMIYOSHI MARU
7JOB	26	26	0	SHINKASHU MARU
8JNZ	91	91	0	KOFU MARU
9VUU	34	34	0	CHIEH SHENG

TOTAL BATHYS RECEIVED 10190
TOTAL TESACS RECEIVED 1551
TOTAL REPORTS RECEIVED 11741

U. S. NDBC Climatological Data

October, November and December 1987

BUOY OCTOBER 1987	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX STD WIND (KTS)	MAX STD WIND (DA/HR)	MEAN PRESS (MB)
32302	18.0S	085.1W	692	18.3	19.1	2.1	2.9	21/10	11.8	SE	21.4	18/10	1017.3
41001	34.9N	072.9W	744	21.6	25.1	1.9	5.0	14/17	12.8	NE	32.1	04/03	1017.2
41002	32.2N	075.3W	562	23.1	26.0	2.2	6.8	14/03	12.9	NE	29.8	13/12	1016.3
41006	29.3N	077.4W	744	24.5	26.4	2.0	5.6	13/19	12.0	NE	29.4	13/14	1016.2
42001	25.9N	089.7W	743	24.4	27.3	1.4	3.5	11/03	13.7	NE	23.8	11/01	1018.5
42002	26.0N	093.5W	484	24.7	27.7	1.4	3.0	11/13	12.2	NE	23.5	21/18	1018.7
42003	26.0N	085.9W	483	25.2	27.7	1.5	3.5	12/02	15.3	NE	27.4	12/09	1016.1
42007	30.1N	088.9W	740	19.3	21.8	0.6	1.5	03/12	9.8	E	23.8	21/13	1019.9
42015	30.1N	088.2W	742	19.3		0.5	1.3	23/19	10.0	N	25.3	03/14	1017.7
44004	38.5N	070.6W	743	17.8	22.0	1.9	5.8	04/18	10.9	N	28.1	04/10	1019.2
44005	42.7N	068.3W	743	11.5	12.2	1.5	5.2	04/22	11.4	S	32.3	04/20	1018.1
44006	36.2N	075.5W	414	16.4	18.7	0.9	2.6	04/04	10.1	NW	29.0	04/03	1019.7
44007	43.5N	070.1W	740	10.1	11.1	1.0	3.4	28/18	11.0	S	29.1	04/11	1017.5
44008	40.5N	069.5W	708	12.7	13.0	1.5	4.7	04/18	4.1	N	35.0	04/15	1018.2
44009	38.5N	074.6W	742	14.3	16.5	1.1	2.7	04/02	13.9	NW	35.0	04/00	1020.3
44011	41.1N	066.6W	743	12.7	12.3	1.8	6.2	05/02	10.0	W	26.8	05/02	1018.5
44012	38.8N	074.6W	710	14.0	16.1	1.0	2.6	04/06	13.6	NW	33.0	04/05	1020.4
44013	42.4N	070.8W	605	10.5	11.2	0.7	2.2	28/13	13.5	W	31.1	28/14	1019.9
45001	48.0N	087.7W	742	5.2	6.1	1.0	4.5	02/11	11.1	N	25.9	02/13	1016.9
45002	45.3N	086.4W	742	8.2	11.5	1.2	3.6	01/20	14.3	N	33.0	01/18	1016.7
45003	45.3N	082.8W	741	7.9	11.1	1.0	3.4	10/00	12.5	NW	31.1	01/22	1016.3
45004	47.6N	086.5W	736	5.8	7.9	1.2	5.0	02/12	12.9	N	35.0	02/11	1015.6
45005	41.7N	082.4W	743	10.2	13.3	0.6	2.4	02/08	12.5	S	31.1	02/05	1019.1
45006	47.3N	089.9W	720	6.1	7.6	0.9	4.1	02/12	11.4	SW	33.0	02/07	1016.5
45007	42.7N	087.1W	742	9.4	11.3	1.1	4.8	03/00	12.8	S	31.1	03/02	1012.4
45008	44.3N	082.4W	743	8.7	11.2	1.2	3.4	03/03	14.0	NW	31.1	02/05	1017.3
46001	56.3N	148.3W	740	8.6	9.8	3.2	9.1	21/18	16.0	SW	32.1	21/09	1005.6
46002	42.5N	130.4W	740	15.9	16.7	2.2	5.0	31/14	10.4	N	22.8	31/14	1019.5
46003	51.9N	155.9W	740	8.3	8.4	3.3	9.8	21/02	16.9	W	34.4	20/22	1007.2
46004	50.9N	135.9W	743	11.5	12.8	3.0	10.5	04/23	13.0	SW	34.7	04/17	1019.1
46005	46.1N	131.0W	743	14.9	15.8	2.3	4.8	30/08	10.2	N	22.4	31/09	1020.6
46006	40.8N	137.6W	742	16.4	17.5	2.3	6.5	30/13	11.0	NE	29.1	30/15	1020.7
46010	46.2N	124.2W	738	13.1	12.2	1.7	3.1	26/06	7.1	N	23.3	16/00	1019.8
46011	34.9N	120.9W	678	16.1	17.1	1.4	3.0	23/19	8.0	N	23.4	13/01	1015.9
46012	37.4N	122.7W	740	14.2	14.5	1.4	2.5	03/06	4.3	NW	17.5	03/22	1016.8
46013	38.2N	123.3W	742	13.9	13.8	1.5	3.2	31/23	6.7	NW	26.4	03/01	1016.8
46014	39.2N	124.0W	741	14.1	14.8	1.7	3.4	31/00	7.6	NW	30.2	06/04	1016.8
46016	63.3N	170.3W	246	0.1					0.0	N			1000.7
46022	40.7N	124.5W	076	14.7	14.6	2.1	3.7	31/14	8.6	S	20.9	30/20	1015.3
46023	34.3N	120.7W	311	16.8	17.3	1.6	1.8	01/02	12.9	NW	22.5	08/02	1014.9
46025	33.7N	119.1W	742	18.3	19.4	0.8	1.5	08/02	6.1	W	29.1	01/02	1014.9
46027	41.8N	124.4W	738	12.5	12.3	1.7	3.0	15/03	6.0	N	27.2	15/01	1018.4
46028	35.8N	121.9W	741	15.7	16.3	1.3	2.5	03/13	7.1	NW	21.2	22/17	1016.4
46035	57.0N	177.7W	739	4.1	6.1	2.8	6.9	14/02	16.1	N	36.7	14/04	1000.8
46039	48.2N	123.4W	743	10.8	10.1	0.4	1.3	13/12	4.1	N	23.3	02/07	1020.4
46040	44.8N	124.3W	741	12.9	13.8	1.7	3.3	06/13	7.8	N	21.4	16/00	1019.4
46041	47.4N	124.5W	743	12.5	13.1	1.7	3.9	06/08	5.9	NW	19.4	31/11	1019.8
46043	46.9N	124.2W	742	12.4	11.8	1.6	3.6	30/20	0.0	N			1020.0
51001	23.4N	162.3W	483	25.9	26.4	2.2	3.8	23/09	11.6	E	21.2	22/21	1016.5
51002	17.2N	157.8W	742	26.9	27.6	2.0	3.0	24/07	14.4	E	25.6	22/09	1013.6
51003	19.2N	160.8W	376	27.0	27.9	1.9	3.1	01/18	9.9	E	18.8	01/07	1013.7
51004	17.5N	152.6W	484	26.2	27.1	2.1	3.5	09/13	13.2	E	21.5	29/13	1014.4
51005	20.4N	156.1W	741	25.7	27.0	1.6	2.6	09/02	16.8	SW	23.3	03/17	1015.6
ALRF1	24.9N	080.6W	076	23.3	25.3				14.6	N	32.0	31/04	1018.0
ALSN6	40.5N	073.8W	743	12.7	15.2				13.8	NW	39.1	28/04	1022.7
BURL1	28.9N	089.4W	743	21.1					12.3	N	31.0	21/12	1019.9
BUZM3	41.4N	071.0W	743	12.6					14.4	SW	38.1	04/09	1019.2
CARO3	43.3N	124.4W	741	11.7					5.6	N	24.0	16/01	1019.4
CHLV2	36.9N	075.7W	305	16.3	20.6				14.5	NW	39.1	04/03	1017.6
CLKN7	34.6N	076.5W	729	16.5					10.6	N	28.0	03/21	1020.1
CSBF1	29.7N	085.4W	743	18.7					4.4	N	15.0	07/03	1019.3
DBLN6	42.5N	079.4W	687	9.3					10.2	S	36.1	25/05	1018.1
DESW1	47.7N	124.5W	739	12.2					6.9	SE	31.0	31/13	1020.0
DISW3	47.1N	090.7W	742	6.8					13.3	SW	41.1	02/07	1016.4
DPIA1	30.3N	088.1W	740	18.6	20.1				10.8	N	29.9	21/12	1020.1
DSLN7	35.2N	075.3W	583	18.0	21.4				16.0	N	39.1	13/19	1020.3
FBIS1	32.7N	079.9W	743	17.1					8.6	NE	26.0	26/21	1020.1
FFIA2	57.3N	133.6W	739	7.8					13.1	SE	37.0	05/07	1014.9
FPSN7	33.5N	077.6W	742	19.4					15.8	N	36.1	13/09	1019.0
GDIL1	29.3N	090.0W	741	20.2	21.4				9.7	NE	29.0	21/13	1020.2

U.S. NDBC Climatological Data cont'd

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BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX STD WIND (KTS)	MAX STD WIND (DA/HR)	MEAN PRESS (MB)
GLLN6	43.9N	076.4W	709	10.3					12.7	S	42.1	25/08	1018.5
IOSN3	43.0N	070.6W	734	10.4					12.0	S	36.1	04/10	1018.5
LKWF1	26.6N	080.0W	741	24.7	26.3				12.7	NE	36.1	12/22	1015.4
MDRM1	44.0N	068.1W	742	9.6					13.7	S	36.1	28/15	1018.6
MISM1	43.8N	068.9W	742	9.9					14.5	SW	48.1	28/15	1018.8
NWPO3	44.6N	124.1W	742	11.7					5.9	N	24.0	16/00	1019.2
PILM4	48.2N	088.4W	744	5.2					13.5	N	35.1	09/10	1016.1
PTAC1	39.0N	123.7W	741	13.0					5.9	N	21.0	06/20	1016.9
PTAT2	27.8N	097.1W	741	23.5					10.1	SE	23.0	23/23	1019.5
PTGC1	34.6N	120.7W	262	17.1					10.9	N	28.0	02/06	1015.9
ROAM4	47.9N	089.3W	741	5.8	8.6				17.2	N	46.1	02/08	1015.5
SAUF1	29.9N	081.3W	742	20.6					13.7	N	31.7	13/03	1018.7
SBIO1	41.6N	082.8W	742	9.6					12.3	SW	33.1	02/05	1018.6
SGNW3	43.8N	087.7W	743	7.7	10.5				10.4	W	28.0	01/18	1018.1
SISW1	48.3N	122.8W	737	11.1					4.0	N	22.0	17/03	1019.2
SPGF1	26.7N	079.0W	709	25.3	27.1				10.2	NE	28.9	11/02	1014.7
SRST2	29.7N	094.1W	743	19.8					7.8	SE	22.0	21/14	1020.5
STDM4	47.2N	087.2W	742	6.3	13.2				17.3	N	48.1	02/12	1016.0
SVLS1	32.0N	080.7W	743	18.3	21.7				15.6	NE	35.1	27/01	1019.7
TPLM2	38.9N	076.4W	741	12.8	15.9				11.1	NW	27.0	02/20	1019.9
TTIW1	48.4N	124.7W	739	11.3					11.1	NE	33.1	06/15	1020.2
VENF1	27.1N	082.5W	741	21.6	24.0				9.2	NE	23.0	28/22	1016.3
WPOW1	47.7N	122.4W	741	12.1					5.7	N	17.0	25/19	1020.0
NOVEMBER 1987													
41001	34.9N	072.9W	716	24.6	25.7				11.1	NE	36.6	27/06	1020.1
41002	32.3N	075.3W	712	26.0	27.5	2.0	14.3	26/20	11.8	NE	50.5	27/01	1019.3
41006	29.3N	077.3W	699	26.9	28.1	2.0	8.0	26/11	10.8	NE	29.3	26/15	1017.1
42001	25.9N	089.7W	716	27.6	29.0	1.1	3.5	15/11	11.4	E	25.8	15/13	1015.0
42002	26.0N	093.5W	719	25.4	30.3	1.2	3.8	30/19	13.7	E	33.4	30/19	1014.7
42003	26.0N	085.9W	404	29.0	28.4	1.2	3.6	15/05	15.3	NE	31.4	15/05	1015.3
42007	30.1N	088.9W	717	26.2	26.8	0.7	4.1	02/12	11.4	E	52.5	02/12	1017.0
44004	38.5N	070.6W	426	22.5	25.7	1.3	2.9	01/03	13.1	N	30.3	14/02	1019.4
44005	42.7N	068.3W	717	15.4	15.1	1.2	6.5	28/02	8.7	SW	29.0	28/00	1019.7
44007	43.5N	070.1W	717	15.4	14.5	0.8	6.0	28/00	8.4	SW	44.7	27/22	1019.4
44008	40.5N	069.5W	360	17.1	16.0				8.2	SW	35.0	27/17	1021.0
44009	38.5N	074.6W	711	21.7	23.1				9.8	N	48.6	27/15	1020.5
44011	41.1N	066.6W	720	17.8	18.7	1.7	7.6	28/05	9.7	N	27.1	27/23	1019.6
44012	38.8N	074.6W	708	21.7	22.7				9.8	N	42.7	27/11	1020.4
44013	42.4N	070.8W	717	16.8	16.5				8.8	SW	46.6	27/20	1019.9
45001	48.0N	087.7W	702	11.1	10.5	0.9	4.7	24/16	10.1	N	36.9	30/23	1016.4
45002	45.3N	086.3W	707	16.0	17.4	0.6	1.7	30/23	11.6	SW	33.0	24/03	1018.1
45003	45.3N	082.8W	717	15.6	16.5	0.8	2.6	24/03	10.1	SW	25.3	24/08	1018.5
45004	47.2N	086.5W	716	12.4	11.9	0.8	3.9	24/07	10.0	S	29.5	24/04	1016.9
45005	41.7N	082.4W	500	20.6	22.3	0.5	1.6	11/05	8.1	SW	19.2	11/03	1021.9
45006	47.3N	089.8W	715	11.8	10.8	0.7	3.7	30/19	8.8	NE	29.1	24/06	1016.0
45007	42.7N	087.1W	717	18.2	19.4	0.8	3.0	24/01	12.0	S	31.1	24/00	1018.9
45008	44.3N	082.4W	719	16.4	16.9	0.8	3.0	24/07	9.5	S	25.3	24/05	1018.7
46001	56.3N	148.3W	719	11.6	11.8	2.6	6.6	19/16	14.0	W	29.8	29/12	1016.4
46002	42.5N	130.3W	717	15.9	16.8	2.2	4.7	12/13	15.5	N	22.9	17/18	1018.9
46003	51.9N	155.9W	715	12.0	11.7	2.5	6.9	29/06	15.0	SW	32.7	29/00	1018.5
46004	50.9N	135.9W	720	13.4		2.2	4.5	17/12	12.8	NW	26.8	12/04	1021.2
46005	46.1N	131.0W	441	14.8	15.6	1.7	3.3	18/17	15.4	N	26.9	05/15	1023.6
46006	40.8N	137.6W	718	16.3	17.5	1.9	3.6	12/10	10.8	N	18.2	24/18	1025.6
46010	46.2N	124.2W	710	13.8	14.3	1.5	3.9	12/20	9.4	N	24.4	12/15	1016.6
46011	34.9N	120.9W	694	15.4	15.5	1.4	2.6	15/07	8.7	NW	22.5	15/01	1015.0
46012	37.4N	122.7W	718	15.0	15.0	1.3	2.4	19/07	6.7	NW	19.8	15/04	1015.1
46013	38.2N	123.3W	715	13.4	13.2	1.7	3.1	19/02	7.5	NW	26.1	03/01	1015.2
46014	39.2N	124.0W	602	13.0	13.3	1.7	3.5	19/04	7.0	NW	22.7	18/03	1015.2
46016	63.3N	170.3W	177	4.2					10.3	N	37.6	14/06	1007.0
46017	60.3N	172.3W	176	5.7					12.7	S	27.9	26/03	1006.0
46022	40.8N	124.5W	716	13.1	13.1	1.9	4.5	05/03	8.0	N	22.0	18/11	1015.5
46023	34.3N	120.7W	715	16.1	16.5	1.6	2.9	15/11	12.0	NW	25.4	02/14	1015.2
46024	32.8N	119.5W	712	18.0	19.2	1.6	3.4	15/16	10.6	NW	21.3	02/21	1014.8
46025	33.6N	119.0W	718	18.7	20.0	1.0	2.4	03/05	6.7	W	22.1	03/02	1013.3
46026	37.8N	122.7W	711	13.9	14.5	1.1	1.8	15/02	6.9	W	19.4	15/04	1015.7
46028	35.8N	121.9W	719	15.5	15.5	1.7	3.1	15/05	9.5	NW	25.6	16/05	1014.5
46030	40.4N	124.5W	716	12.3	12.5				6.5	N	19.4	21/13	1015.5
46035	57.0N	177.7W	378	7.5		2.1	6.2	25/11	10.1	N	27.2	25/01	1006.4
51001	23.4N	162.3W	719	25.8	26.9	1.9	2.9	10/16	10.3	E	22.2	18/04	1016.0
51002	17.2N	157.8W	718	25.8	26.9	1.9	3.2	07/17	11.6	E	21.0	17/15	1013.4

U.S. NDBC Climatological Data cont'd
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BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX STD WIND (KTS)	MAX STD WIND (DA/HR)	MEAN PRESS (MB)
51003	19.2N	160.8W	714	26.6	27.6	1.7	2.6	18/11	8.6	E	17.6	20/03	1014.5
51004	17.5N	152.6W	715	25.6	26.5	2.1	3.7	07/17	11.8	NE	22.3	19/02	1012.6
ALRF1	24.9N	080.6W	718	27.1	28.3				11.6	E	34.1	15/11	1015.6
ALSN6	40.5N	073.8W	719	20.0					12.5	NE	58.1	27/18	1020.7
BURL1	28.9N	089.4W	706	26.8					12.5	NE	34.1	02/17	1016.6
BUZM3	41.4N	071.0W	717	18.0					12.2	SW	57.1	27/18	1020.3
CARO3	43.3N	124.4W	719	12.6					7.3	N	25.0	12/10	1017.2
CHLV2	36.9N	075.7W	719	22.8	24.4	1.0	6.2	27/10	11.8	NE	72.1	27/10	1020.3
CLKN7	34.6N	076.5W	714	23.4					11.7	NE	56.1	27/05	1020.1
CSBF1	29.7N	085.4W	718	25.3					5.5	NE	38.1	02/00	1017.5
DBLN6	42.5N	079.4W	719	18.3					8.6	SE	24.0	24/11	1020.5
DESW1	47.7N	124.5W	718	12.8					7.9	NW	35.1	12/20	1016.5
DISW3	47.1N	090.7W	716	12.6					11.1	SW	37.1	24/08	1016.0
DSLN7	35.2N	075.3W	718	24.2	26.1				12.6	N	84.1	27/05	1020.2
FBIS1	32.7N	079.9W	717	24.4					9.6	NE	23.0	14/04	1020.3
FFIA2	57.3N	133.6W	719	9.9					8.0	N	31.0	25/00	1017.6
FPSN7	33.5N	077.6W	718	24.6	26.4				13.9	NE	54.1	26/22	1019.5
GDIL1	29.3N	090.0W	718	26.5	27.6				9.8	E	24.0	14/21	1016.6
GLLN6	43.9N	076.4W	718	17.0					9.3	S	28.0	27/23	1019.6
IOSN3	43.0N	070.6W	717	16.2					10.9	NE	55.1	27/21	1019.3
LKWF1	26.6N	080.0W	713	27.1	27.8				10.0	E	26.0	15/02	1016.2
MDRM1	44.0N	068.1W	714	13.5					10.6	SW	43.1	27/22	1019.6
MISM1	43.8N	068.9W	719	13.7					11.0	SW	49.1	28/00	1019.9
NWPO3	44.6N	124.1W	718	12.7					6.7	N	25.0	12/10	1016.9
PILM4	48.2N	088.4W	718	11.7					11.9	S	44.1	24/10	1015.8
PTAC1	39.0N	123.7W	718	12.5					5.9	N	20.0	19/19	1014.8
PTAT2	27.8N	097.1W	656	27.3					14.6	E	31.0	29/23	1014.2
PTGC1	34.6N	120.7W	697	15.4					11.2	N	26.0	02/10	1015.2
ROAM4	47.9N	089.3W	701	11.8					14.1	SW	43.1	24/12	1015.9
SBIO1	41.6N	082.8W	718	19.6					8.3	SW	28.0	24/06	1020.9
SGNW3	43.8N	087.7W	717	15.7					10.5	S	33.1	23/23	1017.7
SISW1	48.3N	122.8W	720	12.3					6.7	W	30.0	17/04	1016.7
SJLF1	30.4N	081.4W	719	25.6					11.2	NE	41.1	01/11	1018.5
SRST2	29.7N	094.1W	717	25.8					11.0	SE	32.0	06/10	1016.1
STDM4	47.2N	087.2W	709	12.9					14.5	S	41.1	24/05	1016.9
SVLS1	32.0N	080.7W	719	24.9	26.4				14.7	NE	35.1	14/07	1019.4
TTIW1	48.4N	124.7W	718	11.8					8.9	E	25.0	17/07	1017.2
WPOW1	47.7N	122.4W	720	13.1					6.0	N	27.0	06/18	1016.8
DECEMBER 1987													
32302	18.0S	085.1W	719	19.4	19.8	2.0	3.1	16/04	11.7	SW	19.4	07/15	1015.7
41001	34.9N	072.9W	744	15.7	21.7	2.7	8.1	30/17	0.0	N			1016.3
41002	32.2N	075.3W	247	18.3	21.6	2.3	6.6	30/09	13.9	SW	30.9	05/00	1018.8
41006	29.3N	077.4W	424	20.3	23.1	2.0	5.8	29/20	12.4	S	29.8	29/15	1020.8
42001	25.9N	089.7W	294	21.7	25.0	1.1	4.4	15/21	11.3	SE	27.1	14/03	1018.3
42002	26.0N	093.5W	247	21.3	23.6	1.4	5.0	15/12	13.7	SE	33.0	15/06	1017.6
42003	26.0N	085.9W	022	20.6	23.3				7.4	NW	16.9	01/21	1017.3
42007	30.1N	088.9W	744	14.7	15.0	0.7	2.1	07/18	9.7	SE	21.5	29/14	1018.5
42015	30.1N	088.2W	540	15.3	16.1	0.8	2.6	07/22	9.5	E	26.4	29/07	1020.0
44004	38.5N	070.6W	274	11.1	17.9	2.6	7.9	30/15	11.2	N	38.1	29/18	1013.6
44005	42.7N	068.3W	743	3.5	6.9	2.1	6.0	30/09	15.2	NW	32.5	11/22	1011.0
44006	36.2N	075.5W	728	8.6	10.0	1.2	4.3	29/23	13.1	NW	32.8	30/00	1018.3
44007	43.5N	070.1W	738	1.4	5.9	0.9	4.2	16/10	13.5	N	35.0	30/08	1011.8
44008	40.5N	069.5W	707	5.1	7.4				17.9	NW	45.7	29/22	1012.4
44009	38.5N	074.6W	742	6.5	9.0	1.2	4.1	30/02	16.0	NW	38.9	30/05	1017.2
44011	41.1N	066.6W	439	4.8	7.1	3.0	8.2	30/06	15.8	NW	38.0	30/00	1011.1
44012	38.8N	074.6W	700	5.9	8.3	1.1	3.4	30/03	15.2	NW	36.9	17/03	1017.3
44013	42.4N	070.8W	742	2.5	6.1	0.8	3.2	16/04	9.5	N	34.8	30/13	1012.6
45001	48.0N	087.7W	744	-1.5	3.7	1.1	4.6	27/01	0.0	N			1013.3
46001	56.3N	148.3W	741	3.2	5.7	3.9	8.7	06/03	16.4	W	34.2	06/00	1000.0
46002	42.5N	130.4W	744	10.5	12.5	4.4	10.8	01/17	16.6	N	34.6	07/22	1016.8
46003	51.9N	155.9W	742	3.3	4.2	5.0	11.9	20/03	21.8	W	43.7	05/18	1005.1
46004	50.9N	135.9W	472	6.8	9.1	4.4	9.5	01/23	15.1	SW	33.4	05/09	1010.8
46005	46.1N	131.0W	743	9.1	11.3	4.6	13.6	01/21	17.0	NW	40.0	08/05	1013.6
46006	40.8N	137.6W	438	9.9	12.2	4.2	11.4	01/14	19.3	N	47.7	07/21	1018.9
46010	46.2N	124.2W	743	7.3	9.7	3.6	8.6	02/03	17.1	E	49.2	01/09	1015.9
46011	34.9N	120.9W	248	11.9	13.7	3.2	6.4	02/18	13.8	N	39.5	16/09	1018.7
46012	37.4N	122.7W	741	11.6	12.9	3.0	7.0	16/13	12.9	SE	35.0	06/15	1019.2
46014	39.2N	124.0W	743	11.2	12.5	3.7	8.7	02/09	15.2	SE	38.8	06/09	1018.2
46022	40.7N	124.5W	743	10.7	11.9	3.8	9.8	02/06	18.7	S	45.1	06/11	1018.2
46025	33.7N	119.1W	743	13.1	14.4	1.5	7.2	16/20	9.5	NW	37.0	16/20	1017.6
46027	41.8N	124.4W	736	9.9	11.5	3.6	9.4	02/06	16.9	S	38.9	08/05	1018.5
46028	35.8N	121.9W	743	12.6	13,8	3.0	6.3	16/14	13.2	SE	37.5	16/09	1019.3

U.S. NDBC Climatological Data cont'd

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BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX STD WIND (KTS)	MAX STD WIND (DA/HR)	MEAN PRESS (MB)
46035	57.0N	177.7W	731	-0.8	3.1	3.8	13.1	15/13	19.5	N	45.1	15/18	994.2
46039	48.2N	123.4W	728	6.2	8.9	0.7	2.7	02/18	0.7	N	35.0	01/06	1015.6
46040	44.8N	124.3W	743	9.6	11.3	3.9	9.7	01/10	13.0	SE	36.9	01/09	1016.6
46041	47.4N	124.5W	743	7.0	9.6	3.5	9.3	02/02	13.4	SE	36.9	08/07	1015.2
46042	36.8N	122.4W	689	11.6	12.9	3.4	9.1	16/12	13.4	SE	38.9	16/10	1018.4
51002	17.2N	157.8W	712	25.1	25.8	2.8	4.5	01/00	15.9	E	25.1	14/07	1013.7
51004	17.5N	152.6W	248	24.8	25.6	2.9	4.2	08/04	16.2	E	23.4	26/19	1014.7
51005	20.4N	156.1W	736	24.2	25.3	2.0	3.2	01/00	15.2	E	27.2	06/12	1015.7
ALRF1	24.9N	080.6W	088	19.9	25.2				9.0	N	20.0	03/12	1017.3
ALSN6	40.5N	073.8W	742	4.6	7.6				16.1	NW	41.1	30/10	1015.4
BURL1	28.9N	089.4W	656	16.9					14.5	SE	34.1	15/08	1018.5
BUZM3	41.4N	071.0W	743	3.6					17.1	W	41.1	16/01	1013.3
CARO3	43.3N	124.4W	744	7.4					11.3	S	40.1	08/11	1018.1
CHLV2	36.9N	075.7W	744	8.1	11.0				14.2	NW	37.1	29/21	1018.0
CLKN7	34.6N	076.5W	731	10.9					11.3	NW	30.0	29/20	1018.2
CSBF1	29.7N	085.4W	744	14.9					5.6	E	21.0	29/01	1019.7
DBLN6	42.5N	079.4W	645	2.2					15.1	SW	42.1	16/09	1015.0
DESW1	47.7N	124.5W	744	6.1					14.3	SE	48.1	09/09	1015.0
DISW3	47.1N	090.7W	744	-1.3					12.5	W	35.1	26/22	1014.5
DPIA1	30.3N	088.1W	744	14.6	14.8				11.7	N	30.3	15/10	1018.9
DSLN7	35.2N	075.3W	743	11.5	15.5				17.2	NW	44.1	29/23	1018.0
FBIS1	32.7N	079.9W	743	11.4					7.2	W	22.0	08/03	1019.9
FFIA2	57.3N	133.6W	742	4.0					16.5	SE	39.8	17/20	1005.3
FPSN7	33.5N	077.6W	743	14.6	22.0				16.3	N	41.1	04/08	1018.8
GDIL1	29.3N	090.0W	743	15.9	16.6				10.0	SE	29.0	29/06	1018.6
GLLN6	43.9N	076.4W	703	1.3					14.8	W	36.1	21/02	1013.7
IOSN3	43.0N	070.6W	744	1.6					14.3	W	36.1	30/16	1013.1
LKWF1	26.6N	080.0W	741	20.6	23.9				10.6	NW	24.0	08/00	1019.7
MDRM1	44.0N	068.1W	744	0.7					18.2	NW	43.1	30/21	1011.7
MISM1	43.8N	068.9W	744	1.0					17.9	NW	46.1	16/09	1012.7
MLRF1	25.0N	080.4W	659	22.4	25.0				14.1	SE	26.2	30/04	1019.0
NWPO3	44.6N	124.1W	744	6.0					11.3	E	49.1	01/10	1016.9
PILM4	48.2N	088.4W	743	-2.4					12.8	NW	33.1	26/23	1014.0
PTAC1	39.0N	123.7W	744	9.7					12.4	SE	35.1	06/09	1018.7
PTAT2	27.8N	097.1W	743	15.7					10.3	SE	30.0	14/22	1017.4
PTGC1	34.6N	120.7W	679	11.8					15.7	N	47.1	23/02	1018.4
ROAM4	47.9N	089.3W	743	-1.9	4.0				15.4	N	47.1	26/20	1013.4
SAUF1	29.9N	081.3W	743	15.7					6.9	NW	23.6	05/01	1020.5
SBIO1	41.6N	082.8W	744	1.7					14.7	W	47.1	15/21	1015.5
SGNW3	43.8N	087.7W	742	-0.2	2.1				12.2	W	42.1	15/13	1015.1
SISW1	48.3N	122.8W	743	5.5					12.2	SE	37.1	01/00	1017.7
SPGF1	26.7N	079.0W	700	21.2	23.7				8.7	E	25.9	29/18	1019.3
SRST2	29.7N	094.1W	744	13.2					8.7	SE	28.0	19/18	1018.0
STDM4	47.2N	087.2W	744	-0.7					17.8	NW	42.1	15/21	1013.5
SVLS1	32.0N	080.7W	743	13.4	14.6				14.1	NE	41.6	29/13	1020.0
TPLM2	38.9N	076.4W	742	5.3	6.3				10.6	NW	32.0	17/05	1016.8
TTIW1	48.4N	124.7W	742	6.3					14.3	E	46.1	03/09	1015.0
VENF1	27.1N	082.5W	737	17.8	19.2				7.4	E	29.0	29/11	1019.4
WPOW1	47.7N	122.4W	744	5.6					8.7	S	28.0	09/23	1016.4

Selected Gale and Wave Observations

October, November and December 1987

VESSEL	SHIP CALL	DATE	POSITION LAT. deg.	POSITION LONG. deg.	TIME GMT	WIND DIR. 10 deg.	WIND SPEED kts.	VSBY	PRES WX. code	PRESSURE mbs.	TEMP deg C. Air	TEMP deg C. Sea	SEA WAVES PD. sec	SEA WAVES HGT. ft.	SWELL WAVES DIR	SWELL WAVES PD. sec	SWELL WAVES HGT. ft.
	PACIFIC	OCT.															
LOUIS MAERSK	OXMA	4	45.2 N	162.6 E	06	14	50	1 NM	64	0999.8	14.4	15.0	6	29.5			
THOMAS G. THOMPSON	KGWT	4	50.2 N	144.7 W	18	27	M 50	.5 NM	81	1001.2	10.6	10.8	7	16.5	27	10	32.5
SEALAND ENDURANCE	KGJX	24	24.1 N	120.0 E	06	02	M 55	1 NM	07	1001.5	22.8		9	29.5			
SEALAND ENDURANCE	KGJX	24	24.1 N	120.0 E	18	02	M 65	2 NM	07	1003.0	21.6		9	32.5			
SEALAND ENDURANCE	KGJX	25	24.6 N	120.3 E	06	03	M 45	2 NM	07	1005.0	23.3		9	29.5			
	PACIFIC	NOV.															
MAERSK WAVE	S6BU	2	49.9 N	160.0 E	00	32	M 47	10 NM	02	1011.0	6.0		7	21	30	10	31
EXXON LONG BEACH	WHCA	2	57.2 N	142.2 W	12	23	M 50			0997.0	12.0		7	32.5	16	9	31
PACMAJESTY	D5GO	7	37.2 N	154.1 W	00	28	M 50	5 NM		0999.0	15.0	21.0			27	8	34.5
ORCHID	3EKV5	10	48.9 N	154.5 W	12	30	M 45	1 NM	60	0982.5	8.0	7.0	8	29.5	30	10	34.5
USCGC STORIS	NRVC	10	55.9 N	165.1 W	18	36	M 47			1003.0	0.6	6.1	4	8	36	7	32.5
GREAT LAND	WFDP	17	56.8 N	144.3 W	07	08	M 52	2 NM	60	0979.8	6.7	6.7	9	13	15	9	39
MOBIL MERIDIAN	KGSM	17	57.2 N	140.5 W	18	18	48	5 NM	16	0986.8	6.1	6.6	2	6.5	18	9	32.5
GREAT LAND	WFDP	17	56.4 N	141.5 W	18	20	M 50	5 NM	50	0985.0	5.6	6.7	9	13	19	12	34.5
MOBIL MERIDIAN	KGSM	18	56.9 N	140.0 W	00	22	50	5 NM	25	0996.2	6.1	7.2	2	8	22	8	32.5
ORCHID #2	DZSI	18	46.5 N	153.8 E	06	34	M 50	2 NM	07	1002.0	1.5	6.9	10	29.5	28	11	28
ALVA MAERSK	OZSD	19	39.1 N	170.2 E	00	26	45	10 NM	58	1007.0	14.6		8	29.5			
MOBIL ARCTIC	KSPY	24	52.0 N	136.6 W	00	23	M 60	5 NM		0988.5	9.4	7.8	5	16.5	23	10	29.5
PRESIDENT TYLER	WEZM	24	40.0 N	161.5 W	06	20	M 52	1 NM	82	1001.1	14.4	11.7	6	32.5	17	6	3
POLAR ALASKA	5LEU	24	37.6 N	142.9 E	18	30	M 50	5 NM		1016.0	7.0	21.0	8	32.5	30	8	32.5
POLAR ALASKA	5LEU	25	39.1 N	143.5 E	00	35	M 50			1017.0	6.0	12.0	8	32.5	30	8	32.5
PACIFIC ARROW	JGFM	25	42.9 N	170.4 W	00	27	M 45			0983.0	9.0		5	13	29	8	32.5
POLAR ALASKA	5LEU	25	40.4 N	144.2 E	06	31	M 50	5 NM	25	1016.0	4.0	13.0	6	32.5	30	8	32.5
PACIFIC ARROW	JGFM	25	43.2 N	168.0 W	06	28	M 45			0992.0	8.5		5	14.5	28	12	29.5
	ATLANTIC	NOV.															
MORMACSUN	WMBK	17	43.5 N	37.4 W	12	27	50	5 NM		1003.5	10.6	16.5	10	24.5	28	10	31
MORMACSUN	WMBK	18	43.5 N	40.8 W	12	02	45	5 NM		1018.5	12.8	16.7	4	19.5	02	6	29.5
CHELSEA	KNCX	22	41.7 N	52.8 W	12	15	50	.5 NM	81	1007.0	19.4	17.8	6	19.5	19	9	36
CHELSEA	KNCX	22	41.6 N	53.3 W	18	23	52	2 NM		1006.4	16.7	18.3	6	18	22	9	31
	PACIFIC	DEC.															
SANSINENA II	WSIN	1	47.8 N	136.4 W	12	27	M 50	5 NM	82	0965.0	7.8	10.0	6	14.5	24	11	59
TARGET	ELEK6	1	47.9 N	137.2 W	18	28	45	5 NM	07	0977.0	9.0	8.0	8	24.5	27	11	29.5
THOMPSON PASS	WSRY	1	48.2 N	131.6 W	18	21	48	1 NM		0974.0	8.3	11.7	5	19.5	23	10	42.5
KEYSTONE CANYON	KSFK	2	50.0 N	135.1 W	00	28	50	5 NM		0974.0	7.2	10.6	9	32.5	29	12	49
WESTWOOD MARIANNE	DVPV	3	40.0 N	154.7 E	00	27	M 52			1000.0	8.0	15.0	8	29.5	27	8	26
WESTWOOD MARIANNE	DVPV	3	40.3 N	156.3 E	06	30	M 48	5 NM	03	1000.0	7.0	15.0	8	29.5	27	8	26
PROSPERIDAD	DZWS	4	48.3 N	143.4 W	18	14	M 54	200 YD	63	0973.0	3.0	9.7	11	29.5	13	14	36
SANKO DILIGENCE	3ERI3	5	49.6 N	136.6 W	06	14	M 59	2 NM	18	0973.5			14	29.5	14	12	19.5
ARILD MAERSK	OXTH	5	49.1 N	137.3 W	06	15	55	.5 NM	25	0969.5	9.0		6	29.5			
ASPEN	KACN	5	56.5 N	141.9 W	18	10	50	1 NM	07	0976.0	5.6	6.1	3	19.5	09	5	42.5
MOBIL MERIDIAN	KGSM	5	51.9 N	132.9 W	18	14	49	5 NM	07	0974.9	8.3	10.0	2	6.5	14	13	42.5
ASPEN	KACN	6	56.0 N	142.5 W	00	14	50	.5 NM	65	0968.0	5.6	6.1	11	18	09	8	39
MANUKAI	KNLO	6	35.1 N	131.0 W	00	21	M 45	5 NM		1000.0	16.6	15.5	7	29.5	21	7	16.5
REGINA MAERSK	OXGR	7	48.2 N	139.3 W	00	25	M 45	10 NM	02	0979.7	6.0	9.0	8	26	25	11	32.5
ASPEN	KACN	8	46.0 N	130.6 W	12	28	50	5 NM		0996.0	10.0	11.1			29	11	39
SANSINENA II	WSIN	9	45.9 N	127.9 W	23	20	50	2 NM	81	0993.2	11.7	11.7	6	21	27	12	32.5
SANSINENA II	WSIN	10	46.1 N	128.4 W	06	26	45	2 NM	81	1003.0	10.0	11.7	6	19.5	27	12	32.5
SANSINENA II	WSIN	10	46.5 N	129.1 W	18	27	45	5 NM	01	1018.2	8.9	11.7	6	19.5	27	12	32.5
TEXACO FLORIDA	KEHS	14	52.9 N	134.0 W	06	28	47	2 NM	26	1012.0	5.5	12.2	7	13	29	10	42.5
LOUISE LYKES	WLCV	16	28.5 N	127.0 W	18	30	M 45	10 NM	25	1008.7	16.7	16.7	6	10	31	13	36
LOUISE LYKES	WLCV	17	29.8 N	126.2 W	06	34	M 48	5 NM		1006.2	16.1	15.6	6	11.5	34	12	36
LOUISE LYKES	WLCV	17	30.1 N	126.1 W	12	33	M 57	5 NM	01	1005.8	15.6	15.6	6	11.5	33	12	41
PRESIDENT WASHINGTON	WHRN	24	52.6 N	172.8 W	06	31	50	5 NM	26	0984.0	0.0	4.4	6	24.5	31	12	32.5
PRESIDENT WASHINGTON	WHRN	24	52.6 N	175.5 W	12	30	55	5 NM		0993.0	0.0	4.4	8	32.5	30	8	32.5
VESSEL	SHIP CALL	DATE	POSITION LAT. deg.	POSITION LONG. deg.	TIME GMT	WIND DIR. 10 deg.	WIND SPEED kts.	VSBY	PRES WX. code	PRESSURE mbs.	TEMP deg C. Air	TEMP deg C. Sea	SEA WAVES PD. sec	SEA WAVES HGT. ft.	SWELL WAVES DIR	SWELL WAVES PD. sec	SWELL WAVES HGT. ft.
	ATLANTIC	DEC.															
MARGARET LYKES	KRJL	5	38.0 N	61.2 W	18	24	50	5 NM	16	0978.7	17.2	20.0	6	19.5	24	9	36
NOSAC TRIGGER	ELDU4	13	35.4 N	17.4 W	06	26	M 45	5 NM		1007.0	17.0	17.0			26	10	32.5
RAINBOW HOPE	KNDB	13	42.0 N	60.0 W	18	30	49	10 NM	27	0990.0	6.7	12.2	9	29.5	29	10	31
SEALAND PIONEER	WSVB	15	35.8 N	51.4 W	06	29	M 47	5 NM		0997.8	15.0		7	16.5	32	10	29.5
SEALAND PIONEER	WSVB	15	35.7 N	52.6 W	12	28	M 60	5 NM	82	0998.0	14.0		7	16.5	30	10	36
SEALAND PIONEER	WSVB	15	35.5 N	53.5 W	18	30	M 49	5 NM	16	1001.0	17.0		7	16.5	31	11	36
SEALAND PIONEER	WSVB	16	35.3 N	54.5 W	00	30	M 50	5 NM	18	1007.0	15.0		7	16.5	31	10	39
SEALAND PIONEER	WSVB	17	37.5 N	64.8 W	18	30	M 52	2 NM	81	0990.0	9.0		7	14.5	30	10	31
SEALAND PIONEER	WSVB	18	37.6 N	65.7 W	00	30	M 60	2 NM	81	0998.0	8.0		7	16.5	30	10	36
AUSTANGER	3FXH	22	50.3 N	27.9 W	18	20	58	2 NM		0990.0	11.0	11.0	8	39	20	8	42.5
EXPORT FREEDOM	WCJS	24	34.4 N	47.4 W	18	27	45	5 NM	02	1013.0	17.2	19.4	6	16.5	27	10	32.5
AUSTANGER	3FXH	25	48.3 N	41.4 W	12	32	58	50 YD	62	0983.0	8.0	12.0	8	39	30	8	42.5
HUMBER ARM	D5OY	30	40.6 N	67.3 W	00	03	M 55	200 YD	69	0992.0	0.0		13	26	01	14	29.5
LIONS GATE BRIDGE	JCLL	30	40.6 N	63.4 W	06	29	M 62	2 NM	07		4.0		6	24.5	XX	XX	36

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